JUNE 1, 1961

AUTOMOTIVE INDUSTRIES

ENGINEERING · MANAGEMENT · PRODUCTION · DESIGN

A CHILTON PUBLICATION

OTAC Research

EXCLUSIVE REPORT ..... Page 38

Above: The three men chiefly responsible for the successful development of what is probably the first fully automatic press forging system inspect a track link for a crawler tractor. The link was forged on the initial full production run by the new automatic system. Left to right, Arthur G. Tichenor, president of AmForge; John W. Elbin, division vice president; and Stanley J. Vickers, director of research and development.

SEE PAGE 21

ALSO IN THIS ISSUE . . .

ARC WELDING AXLE HOUSINGS AT BUICK
NEW CLUES TOWARD MORE MOBILITY
NEW POWER-SHIFT TRANSMISSION

minute particles of lead...

improve surface finish

On these center aligning balls used in automotive universal joints, CHARLESTON METAL PRODUCTS switched from A.I.S.I. 52100 to the same grade of steel *leaded.** They now report improved surface finish . . . a 15% increase in tool life . . . more uniform tolerances in finished parts. They also note that wear and shock resistance are not affected and uniform high hardness (RC 62-63) is maintained. Distortion remains at a minimum.

Results like these are not at all unusual when users switch to free-machining Aristoloy lead-treated steels.

For complete information about Aristoloy *electric furnace* bars and billets—call your local Copperweld representative or write today.

*Inland Ledloy License

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DIVISION OF
COPPERWELD STEEL COMPANY

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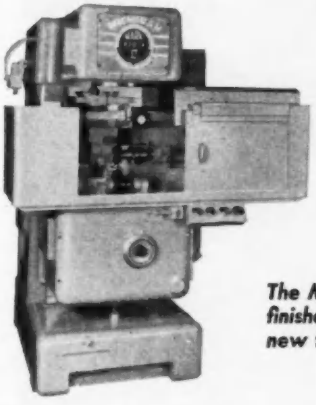
ARISTOLOY STEEL DIVISION 4025 Mahoning Ave., Warren, Ohio • EXPORT: Copperweld Steel International Co., 225 Broadway, New York 7, N. Y.

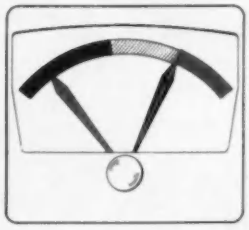
NO. 2 IN A SERIES

SOLUTIONS TO GEAR PROBLEMS

WANTED: AUTOMATIC WARNING WHEN SHAVING CUTTERS ARE DULL

This has been solved in the new Mark II gear finisher. An indicator connected to the cutter drive circuit registers power required to drive the cutter, warns when preset 'dullness' is reached. Device also protects against cutter breakage by dropping the machine knee or warning if an oversize gear should be loaded into the machine. Ask for Bulletin 870-60.

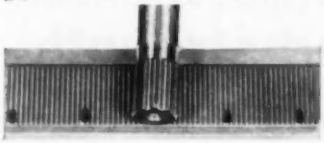




The Mark II gear finisher is full of new features

WANTED: A SIMPLER WAY TO PRODUCE SPLINES 'FOOLPROOF' IN ASSEMBLY

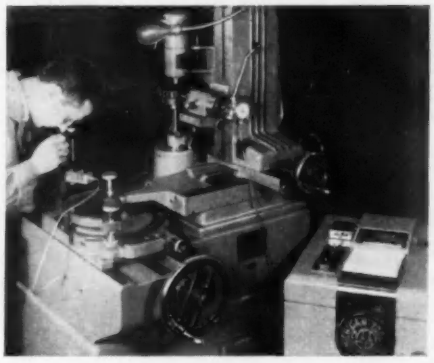
Such splines can be produced without additional operations or time on Roto-Flo machines. A foolproof double-width index-locating spline tooth is created simply by grinding off one end of the forming rack teeth at the locating point. Incidentally, the Roto-Flo produces such a spline in just a few seconds. Ask for Bulletin RF-60.



A Roto-Flo produces splines, threads, grooves, in one pass

WANTED: A WAY TO GET RID OF SETUP AND 'FEEL' ERRORS IN INVOLUTE CHECKING

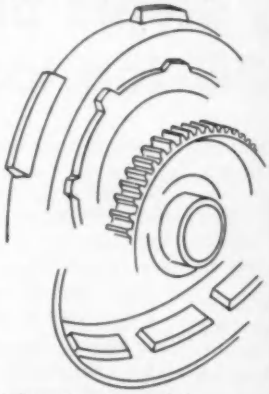
To answer this, we now have available an optical attachment for setting the sine-bar on ANY Michigan Tool #1124 involute checker. Remarkably fast and provides greater setup consistency for increased accuracy. Ask for Bulletin 1124-60.

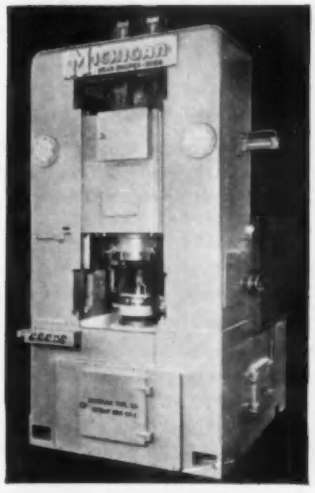


Fast optical sine-bar setting on an 1124 involute checker

WANTED: A SINGLE PROCESS FOR CUTTING ALL KINDS OF INTERRUPTED TOOTH FORMS IN DIFFERENT MATERIALS

We already had the answer to that: the Shear-Speed gear shaper. This machine will cut practically any peripheral shape—spur involute and straight teeth, interrupted or not, cam forms, ratchets, etc., in steel, cast iron, aluminum, and even plastics—in a small fraction of the time required by other processes. Ask for Bulletin 3000-60.





(above) A few of the many shapes produced in one plant by the Shear-Speed

MICHIGAN TOOL COMPANY, 7171 E. McNICHOLS RD., DETROIT 12, MICHIGAN

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Nickel alloy steels provide added strength for cycling 36-ton loads over rough terrain

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- Transmission shafts
- Spiral bevel ring gear
- Integral axle and sun gear

For these parts, 4300 series steels deliver the needed combination of case and core properties for long life in rugged off-the-road service.

Next time you order or design parts for heavy construction machinery, remember that nickel alloy steels give your equipment added strength and toughness. For engineering data to help you select the best steels for specific applications, write to Inco. We'll be glad to help.

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AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE • PUBLISHED SEMI-MONTHLY

JUNE 1, 1961

Passenger Cars • Trucks • Buses • Aircraft • Tractors • Engines • Bodies • Trailers • Road Machinery • Farm Machinery • Parts and Components • Accessories • Production and Processing Equipment • Design • Production • Engineering • Management

VOL. 124 No. 11

Features • • •

▼ **Developments in Machine Tools Viewed at 25th Anniversary Conference**

Many programmed activities, and a heavier than usual participation, marked the Machine Tool Forum sponsored by Westinghouse Electric Corp. Page 35

▼ **New Clues Toward More Mobility**

Some important new concepts for off-highway vehicle design, developed by the Ordnance Tank-Automotive Command, are described and illustrated. Page 38

▼ **Automatic Machining and Assembly of Connecting Rods at Evinrude**

Evinrude Motors, a Division of Outboard Marine Corp., has recently added an automatic assembly machine to its line of multi-operation machines for connecting rods. Page 42

▼ **Arc Welding Rear Axle Housing at Buick**

Most of the welding operations on rear axle housings at Buick are performed with the recently-developed Innershield arc-welding technique. Page 44

▼ **Special Purpose Machines Bore Tractor Gear Case**

Allis-Chalmers Mfg. Co.'s Construction Machinery Division has a special setup for boring welded steel gear cases used on its largest motor scraper models. Page 47

▼ **New Power Shift Transmission**

Especially designed for construction or materials-handling vehicles, a new transmission provides four speeds forward and four in reverse. Page 48

▼ **Cold Extrusion Process New at Saginaw Steering Gear**

Latest Development at Saginaw Steering Gear Division of General Motors Corp. is the volume production of ball joint housings by cold extrusion. Page 50

▼ **Machining Axle Housings and Cylinder Heads**

Automated equipment is used on the production lines for axle housings and cylinder heads at the Waterloo Tractor Works of Deere & Co. Page 52

▼ **Die Quenching Machine for Chassis Frame Side Rails**

A. O. Smith Corp. has developed a die quenching machine that hardens chassis frame side rails without distortion. Page 66

▼ **18 New Product Items and Other Features Such as:**

News of the Machinery Industry; Industry Statistics; and News of the Automotive and Aviation Industry.

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MEMBER SBME Society of Business Magazine Editors

NBP National Business Publications, Inc.

BPA Business Publications Audit of Circulation

AUTOMOTIVE INDUSTRIES is a consolidation of The Automobile (weekly) and the Motor Review (weekly) May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

EDITORIAL EXECUTIVE OFFICES, Chestnut and 56th Sts., Philadelphia 39, Pa., U. S. A. Cable address—Autoland, Philadelphia.

AUTOMOTIVE INDUSTRIES. Published semi-monthly by Chilton Company, Chestnut & 56th Sts., Phila. 39. Second Class Postage Paid at Philadelphia, Pa. Subscription price: To manufacturers in and suppliers to the automotive industries in the U. S., U. S. Possessions and Canada, $2.00 per year; $3.00 for 2 years. All Others, $10.00 per year. Single copies, 75¢. Statistical Issue and Products Guide Issue, $2.00 each net. National Auto Show Issue $1.50 per copy net.

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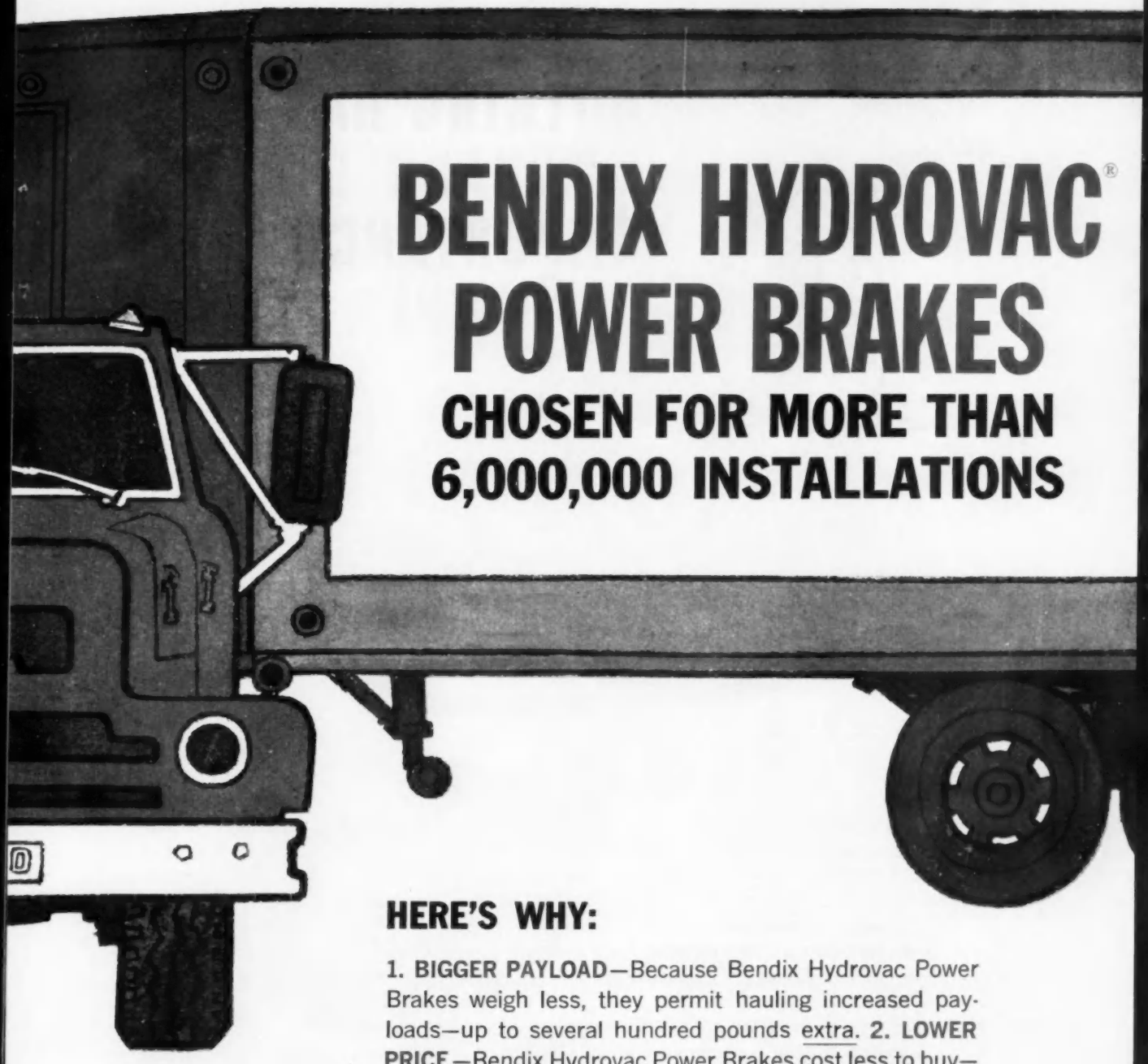

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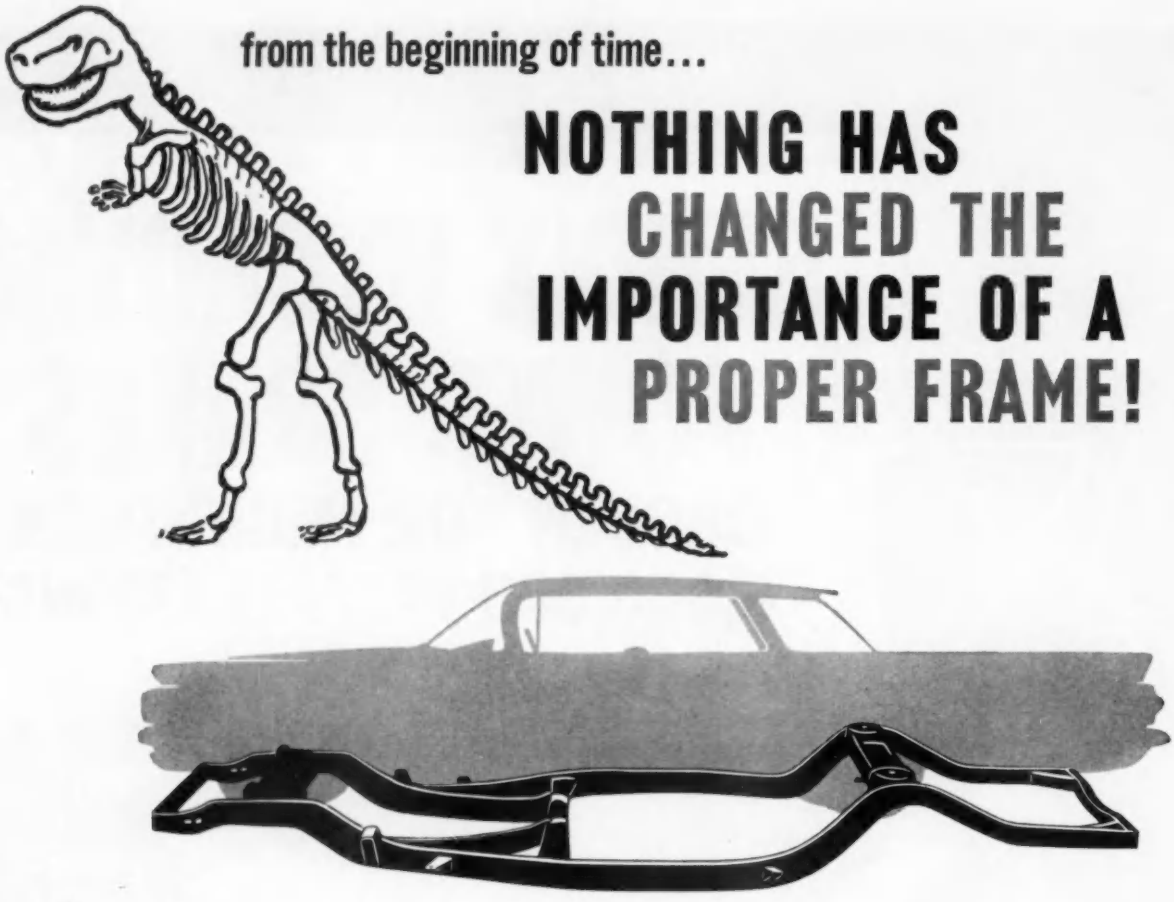
THE Bendix CORPORATION

from the beginning of time...

NOTHING HAS CHANGED THE IMPORTANCE OF A PROPER FRAME!



As it was with the prehistoric dinosaur, the frame—or skeleton—is a vital part of modern passenger cars and trucks—is, in fact, the backbone of the vehicle. And, when all of the factors of rigidity, durability and load support are considered, the *separate* frame provides many important advantages over the unitized concept.

The separate frame benefits both car manufacturer *and* car owner. It's safe, absorbs road shocks with less noise transfer, offers more resistance to stresses and strains. The separate frame allows for flexibility as well as quick design changes—and it permits body repairs and replacements at lower cost.

The separate frame is not a static unchanging structure. Through the years its design has been constantly revised to meet new requirements for passenger comfort and safety. It will continue to be adapted to new driving and styling trends as they occur in the future.

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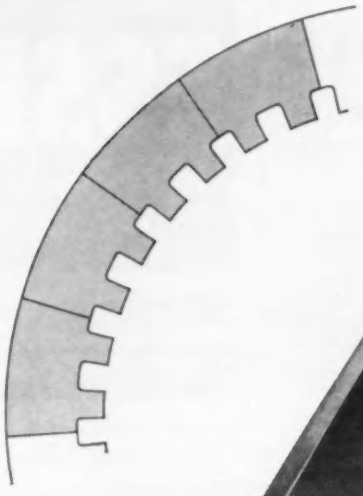

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OIL CONTROL RING

UNISEAL OIL RING

The new Uniseal Oil Ring gives you the advantages of a multi-segment ring in a one-piece oil control ring. Here are some of the important features:

1—Long life is assured through the elimination of pieces which wear against each other.

2—Single piece ring offers basic installation and inventory economies.

3—Circumferential expansion action coupled with multi-segment construction gives optimum conformability.

4—High conformability allows low total loading resulting in lower friction.

5—Deep channel construction makes it exceptionally free from carbon clogging.

In the new Uniseal Ring, spaces between the segments close to prevent oil passage. End clearance is maintained by the Uni-Gaps — super spacers, one on either side. Sides are precision ground to provide maximum side sealing of oil groove. Quick seating is accomplished by narrowing the cylinder contact faces. Let us show you other important features of this and other new Ramco Engineered Designs. A phone call or letter will do it.

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Series 101A
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1500 psi Hydraulic
Fits where others won't
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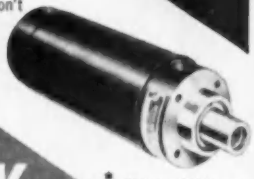

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Mail coupon TODAY for latest Bulletins showing construction and dimensional details, engineering drawings, capacity chart and mounting data.

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CALENDAR

OF COMING SHOWS AND MEETINGS

American Gear Manufacturers Association, Annual Meeting, Hot Springs, Va. .....June 5-7

Instrument Society of America. Instrument-Automation Conference & Exhibit, Pittsburgh .....June 5-8

Society of Automotive Engineers. Summer Meeting, St. Louis....June 5-9

The Society of the Plastics Industries, Inc., 9th Annual Plastics Exposition, New York City....June 5-9

Malleable Founders Society, Annual Meeting, Colorado Springs, Colorado .....June 8-9

American Society of Mechanical Engineers. Annual Summer Meeting, Los Angeles .....June 11-15

Seminars in Industrial Engineering, Cornell University, Ithaca, N. Y. June 13-16

American Society of Mechanical Engineers, Applied Mechanics Conference, Illinois Institute of Technology, Chicago .....June 14-16

Drop Forging Association, Annual Meeting, White Sulphur Springs, W. Va. ..... June 14-17

National Association of Metal Finishers, Annual Convention, Boston .....June 16-19

Material Handling Institute, Great Lakes Show, Detroit .....June 19-21

Massachusetts Institute of Technology, Scientific and Engineering Reports, Cambridge, Mass...June 19-23

American Society for Testing Materials, Annual Meeting, Atlantic City, N. J. .....June 25-30

American Vacuum Society, 5th Annual Conference on Vacuum Metallurgy, Heights Campus, New York U. .....June 26-27

1st International Truck, Trailer and Equipment Show, California Trucking Association, San Francisco .....June 28-30

2nd Joint Automatic Control Conference, Sponsored by: ISA, AICHE, AIEE, ASME, IRE, University of Colorado, Boulder, Colo. .....June 28-30

Western Plant Maintenance and Engineering Show, Los Angeles.July 18-20

Society of Automotive Engineers, West Coast Meeting, Portland, Ore. .....Aug. 14-17

American Society of Mechanical Engineers, International Heat Transfer Conference, Boulder, Colo. Aug. 28-Sept. 1

Combined Farm, Construction and Industrial Machinery; Powerplant; and Transportation Meetings. (Including Production Forum and Engineering Display), Milwaukee Sept. 11-14

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AUTOMOTIVE CABLES

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The thermoplastic insulation is unaffected by motor oils. The tough, smooth surface provides rugged protection for lighting and signal circuits.

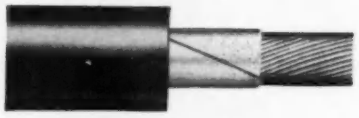
Duplex. This construction with flexible copper conductors, thermoplastic insulation, eliminates fillers and binders. The plastic jacket produces a compact cable of exceptional durability.

2 IGNITION CABLE

Neoprene. Has the superior qualities of special low capacitance "Essex" insulation. This neoprene jacket assures superior resistance to corona, heat, oil and aging.

Plastic. Available in several distinctive colors. A smooth surface and high gloss combine to produce a very pleasing appearance. Made to Essex quality standards.

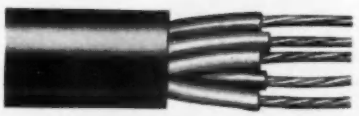
3 BATTERY CABLE



Metaprene. A synthetic insulated battery and ground cable with superior resistance to oil, abrasion and exposure to elements. Insulation is not sensitive to extreme temperature changes.

Plastic. Available in a variety of colors. A quality battery cable that has made a definite place for itself in the auto industry.

4 TRAILER CABLE



Neoprene. Special heavy Neoprene jacket provides greater resistance to oils and greases and finer appearance. This extra quality trailer cable meets the most rugged demands for connection between tractor and trailer.

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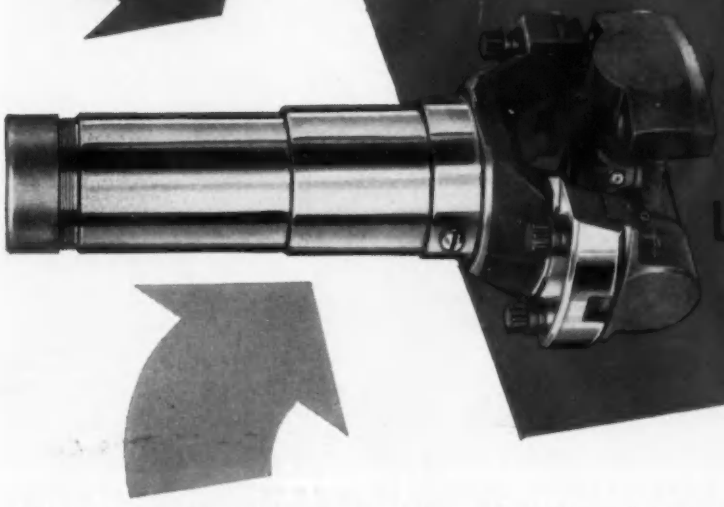
MORE MUSCLE IN A SMALLER PACKAGE...THE NEW

BLOOD BROTHERS "58WB" UNIVERSAL JOINT



To meet new drive line requirements on its 1961 model trucks, a major truck manufacturer needed a special, lightweight but strong universal joint–a unit that would provide greater torque capacity without increasing swing diameter. Rockwell-Standard engineers were consulted, and in a cooperative effort the new "58WB" was developed. It is now being used on several models in the manufacturer's 1961 line.

The design of the new "58WB" is applicable to medium-weight trucks, off-highway equipment, small crawlers and front-end loaders of approximately 1½ yards capacity. It can be made up as a complete drive line, furnished as a component part for a manufacturer's own drive line, or utilized in close-coupled drives. The "58WB" offers these outstanding advantages:

★ **More capacity than any joint of comparable size.** The "58WB" provides 39,000 inch pounds torque capacity with a swing diameter of only six inches!

★ **Key-type yoke.** Requires only four bolts for installation on original equipment. Saves downtime for repairs.

For more details about the new "58WB" or for help in solving any problems involving universal joints or drive lines, write or call us today.

Another Product of...

ROCKWELL-STANDARD
CORPORATION
Universal Joint Division, Allegan, Michigan

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Could this be the most advanced car on the market?

Toy car manufacturers have switched to plastics because they're lighter, easier to process, easier to color and they cost less than competitive metals. These same advantages prompted Detroit designers to use about 22 pounds of plastics per car in 1960. This year, they will use about 30 pounds, and some 1961 models have as many as 200 plastic parts!

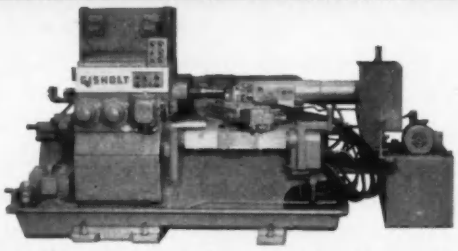
One plastic that is helping to revolutionize automotive design is SUPER DYLAN® high-density polyethylene. SUPER DYLAN molds easily in any color or texture; resists corrosion, scuffing, and heat; and it has excellent rigidity. In today's advanced automobiles, high-density polyethylenes are used for cowl panels, side trim panels, heater ducts, glove boxes, tire covers, and many other applications.

Koppers has a wide range of polyethylenes for almost any application. They are available in densities from .914 to .953 gm./ml. and they can be made into finished products by injection molding, extrusion, blow molding, and thermo-forming. Investigate polyethylenes before you plan your next automotive component, and contact Koppers when you want technical assistance from experts thoroughly experienced in plastics applications. Write or call our Detroit Sales Office: 301 W. Eight Mile Road, Detroit 3, Michigan. Telephone: FOrest 6-5200.

Koppers also makes these other fine plastics: DYLAN® polyethylene, DYLENE® polystyrene, and DYLITE® expandable polystyrene.

KOPPERS PLASTICS

SOMEBODY *is doing it for* LESS



MASTERLINE® NO. 12 Automatic Chucking Lathe—horizontal model shown . . . vertical model is also offered, in addition to a larger, No. 24 Lathe.

As practical for small lots as large production runs.

All three feature rugged construction, ease of control and fast setup. Single- or multiple-pass JETracing (shown) can be part of the automatic cycle for lower tool costs, even faster setup, minimum inspection and increased versatility of the basic machine.

Call your Gisholt Representative or write for Catalog 1213.

Post-mortems on lost orders can be profitable —if you act after the facts are known.

The savings offered by recent developments in Gisholt Automatics may surprise you.

New, faster setup methods up profits on smaller runs. Tracers cut tool costs and handle more complex work. Speed, capacity and horsepower is up . . . for maximum production with carbides.

Act now. Find out how Gisholt Automatics can help you do it for less!

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MACHINE COMPANY
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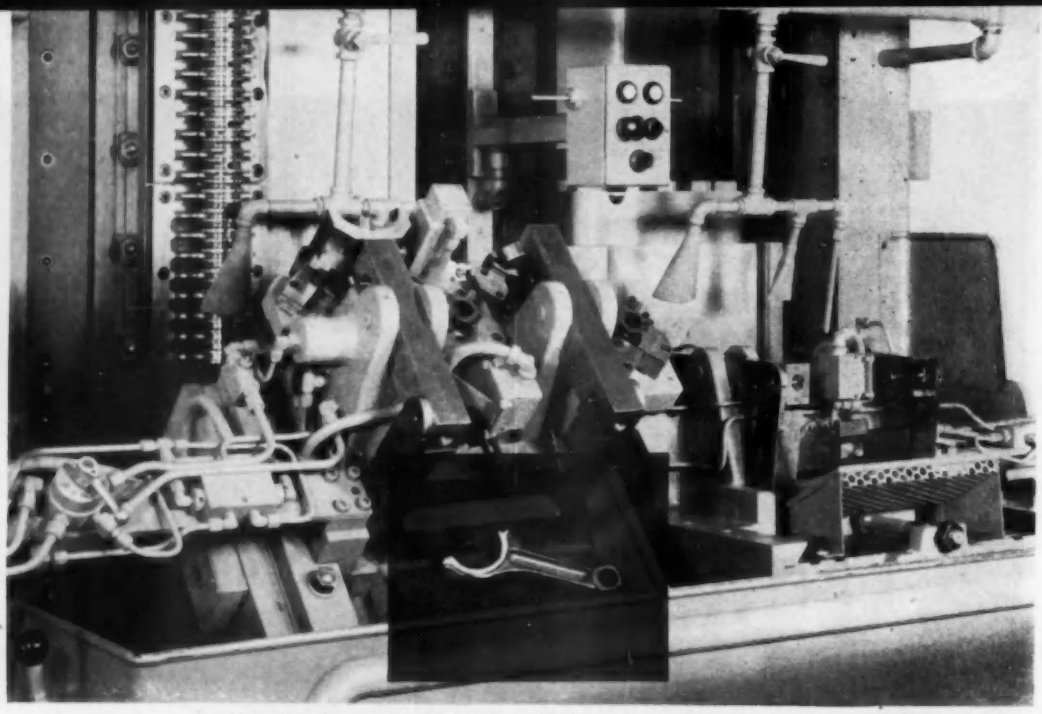
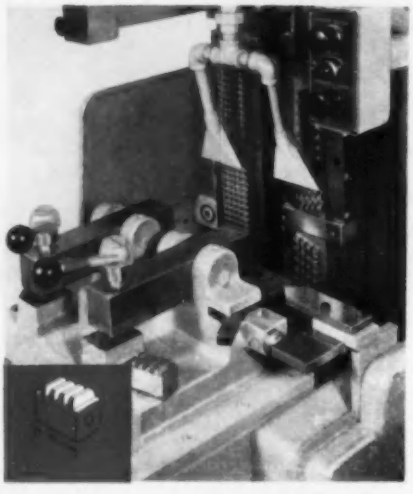
CINCINNATI

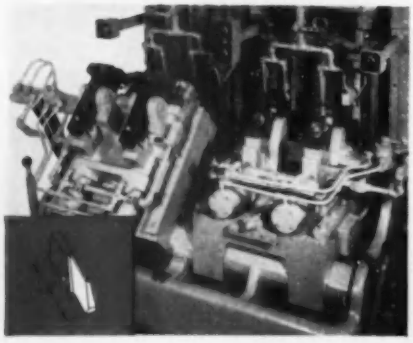


Automatic fixtures on this CINCINNATI No. 15-66 Duplex Vertical give the operator an assist. Operation: broach half-bore, joint faces and slot in connecting rods and caps. Production, 102 pairs per 50 minute hour.

The Finest SURFACE BROACHING *is Performed on Machines* Built *and* Equipped *by* **CINCINNATI**



Coarse pitch rack teeth, requiring 7/16" total depth of cut, are broached in two operations on a No. 10-66 Single Ram Machine. Production, 100 per 50 minute hour.



Six different right and left hand cutter blades are broached on this all-CINCINNATI No. 10-54 Duplex Vertical. Tilt-up tables help the operator load the fixtures. Production, 282 per 50 minute hour.

Surface broaching often is the most economical of all machining operations. It's especially low in cost when performed on a completely equipped CINCINNATI, because two major factors are combined: the finest machine and modern, practical tooling.

Consider the machine for a moment. CINCINNATI Vertical Hydro-Broach Machines are equipped with hardened and ground ways . . . pressure lubrication activated by the hydraulic system . . . interchangeable broach holders . . . simple, constant displacement hydraulic pumps . . . pre-set cycle control. And, for high-quality low-cost production, Cincinnati tooling is the envy of the metalworking industry. Many jobs considered impractical by others have been tooled up very successfully by Cincinnati.

We will be glad to show you how surface broaching can reduce manufacturing costs for a variety of parts. Write today for Catalogs M-1745-1 and M-1848-1, and ask for an Engineering Service appraisal of your surface broaching possibilities. **Milling Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

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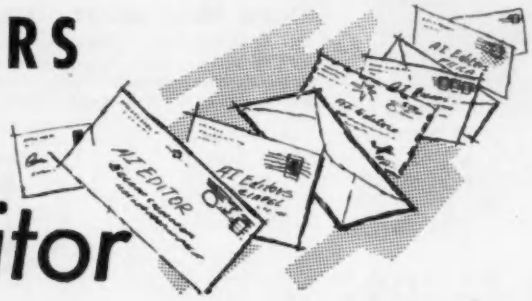
CINCINNATI®

MILLING MACHINE DIVISION

LETTERS to the Editor



Readers' opinions or requests for additional information on material appearing in the editorial pages of AUTOMOTIVE INDUSTRIES are invited for this column. No unsigned letters will be considered, but names will be withheld on request. Address *Letters to the Editor*, AUTOMOTIVE INDUSTRIES, 56th & Chestnut Sts., Philadelphia 39, Pa.

PLASTICS SERIES

We believe that Part I of "Plastics in the Automotive Industries" (AUTOMOTIVE INDUSTRIES, April 1) is extremely well done, and we particularly enjoyed your introductory paragraphs on plastics and their growth in the automotive industry.

Your series will certainly be a success based upon the excellent job you have done in this first article.

Robert D. Forger
Society of Plastics Engineers
Stamford, Conn.

You certainly set a high standard to live by through the rest of the series on automotive plastics. I have heard nothing but rave comments on your "Nylon in the Automotive Industries."

R. D. McGlew
E. I. du Pont de Nemours & Co.
Wilmington, Del.

As you so ably pointed out in your article, nylon has achieved stature in the automotive industry as a desirable material for a wide variety of applications. Taking the time factor alone, it is apparent that the nylon market along with that for similar mechanical type thermoplastics will steadily expand. Historically, the metals have tended to rise in price while the plastics have tended to reduce. Thus, while mechanical success has played an important role in these early stages, surely economics will play a position of increasing emphasis in future material selections.

We were pleased to have had the opportunity of contributing to this comprehensive article.

William H. Chadbourne
President
Fiberfil, Inc.
Warsaw, Ind.

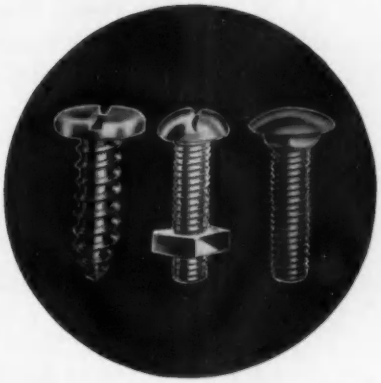
GEM

I have read with interest the letter by Admiral Spangler discussing the Bell Air Cushion Vehicle in your April 15 issue. The license issued by the State of New York is undoubtedly limited since the capabilities of this machine are modest. Nevertheless, the possibility of air cushion vehicles replacing automobiles is a real one.

I would like to correct one flaw in Admiral Spangler's remarks. If the vehicle were moving along a road in a 20 mph crosswind, and this side wind suddenly were to cease, the vehicle would not immediately move across the road at 20 mph. Being possessed of inertia, the vehicle would persist in its original path relative to the earth. In this case, stopping the wind would eliminate a side force of about 50 lb, and would leave an unbalanced control force of the same magnitude. This force acting on this vehicle would produce a lateral motion of approximately 2 in. in the interval of the driver's reaction time. This is somewhat less than the 18 ft. that the Admiral suggests. Furthermore, a vehicle intended for road use could readily be designed so that its heading would change little, if at all, when the direction of the wind changed.

Arthur M. Jackes
(Formerly Chief of Propulsion, Bell)
San Clemente, Calif.

FOR SUPER $AVING$ ON FASTENERS Southern HITS THE SPOT!



Today cost-conscious management men are taking a new hard look at quality fasteners as a partial solution to production problems. These men know that faulty fasteners often take a big toll in profits because of rejects, downtime, waste or spoilage. Likewise, they know that quality fasteners help insure more profitable operations through elimination of needless production hazards.

For super savings all along the line—standardize on USA-made Southern fasteners. Contact your Southern distributor, or write Southern Screw Co., P. O. Box 1360, Statesville, N. C.

Manufacturing and Main Stock in Statesville, North Carolina

WAREHOUSES:
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KNOW YOUR ALLOY STEELS . . .

This is one of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many who may find it useful to review fundamentals from time to time.

Steel

for Strength
. . . Economy
. . . Versatility

Determining the Proper Depth of Case in Alloy Steels

In one of the recent articles in this series we discussed the carburizing of alloy steels, pointing out that the purpose of carburizing is to provide a hard, abrasion-resistant outer shell or "case." Such a discussion naturally gives rise to the question, What factors influence the choice of case? Should it be shallow? Medium? Deep or extra-deep?

While it is not always wise to formulate hard-and-fast rules, the following may be used as a general yardstick:

Shallow cases (less than 0.02 in.). Suitable where wear-resistance alone is the chief requirement, and where good surface condition after heat-treating is advantageous. Not suitable if high stresses are apt to be encountered in service.

Medium cases (0.02 to 0.04 in.). For high wear-resistance. Will stand up under substantial service loads and stresses. The thickness is sufficient to permit certain finishing operations, such as light grinding.

Medium-to-deep cases (0.04 to 0.06 in.). For high wear-resistance. A case in this depth range is essential where continuing friction is involved, especially friction of an abrasive or semi-abrasive nature. It is also a good precautionary measure where application of the finished part may sometimes involve crushing action.

Extra-deep cases (more than 0.06 in.). Cases of this depth can be obtained by extending the furnace time in pack carburizing. Highly wear-resistant, extra-deep cases also withstand shock and impact. A large camshaft of an internal-combustion engine is a good example of a part requiring the extra-deep case. This is especially true of the cam lobes themselves.

If you need advice concerning case-hardened parts, let us arrange for one of our metallurgists to assist you. Bethlehem engineers are always on call, and you can depend on their recommendations. And you can depend on Bethlehem, too, when you need alloy steels; for Bethlehem makes the full range of AISI standard grades, as well as special-analysis steels and all carbon grades.

This series of alloy steel advertisements is now available as a compact booklet, "Quick Facts about Alloy Steels." If you would like a free copy, please address your request to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Sales:* Bethlehem Steel Export Corporation

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DON'T GAMBLE ... with your product's reputation

INSIST ON GENUINE SHAKEPROOF® LIVE ACTION LOCK WASHERS!

Customer loyalty is not a matter of *luck!* It's based on your product's *reputation* for top quality, trouble-free performance! A good reputation depends on the quality of each component used in manufacture *and assembly*. Fasteners—lock washers in particular—carry a big part of this responsibility. Washers that don't measure up to the rest of your product can cause real trouble . . . can actually result in brand switching by your customers.

Don't Gamble! Don't settle for a lock washer that's "good enough." Look alikes don't act alike! Genuine Shakeproof Live Action Lock Washers bite on both sides . . . the only lock washers that lock right—stay tight—where others fail.

TEST THE BEST—FREE! Send for the free Shakeproof Live Action Sample Kit. Includes a wide selection of lock washers and the informative "This Washer Locks Where Others Fail" booklet.

Look for this symbol when you buy or specify to be sure you are getting *Genuine* Shakeproof Live Action Lock Washers!

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STOP DISCARDED CUTTING OIL LOSSES!

A "Cleartex Cure" ends the cutting oil dilution problem forever...cuts per-piece production costs as much as 40%

In spite of precautions, lube oil dilutes the cutting oil in up to 70% of all automatics. This dilution can mean substantial losses in discarded oil. Worse yet—diluted cutting oil can be even more costly in terms of shortened tool life ...increased downtime...a higher percentage of rejects.

Cleartex—triple-purpose oil. In every instance a "Cleartex Cure" eliminates these losses instantly because Texaco Cleartex works in *both* the cutting *and* lubricating sumps of all your automatic screw machines. Acts as a hydraulic fluid, too. The "Cleartex Cure" can cut your per-piece production costs as much as 40%.

How a "Cleartex Cure" works. Getting the benefits of a "Cleartex Cure" is easy. Just have an experienced Texaco engineer come to your plant. He'll survey your automatic set-up . . . tell you which machines can benefit from Cleartex. Chances are, a "Cleartex Cure" can net you considerable savings.

Send for free booklet. Our illustrated booklet, "Cleartex in Automatic Screw Machines" gives full details on how diluted cutting oil may be eating into your profits. To get your copy, plus a survey of your automatics, contact your nearest Texaco distributor—or write Texaco Inc., 135 East 42nd Street, New York 17, N. Y., Dept. AI-100.

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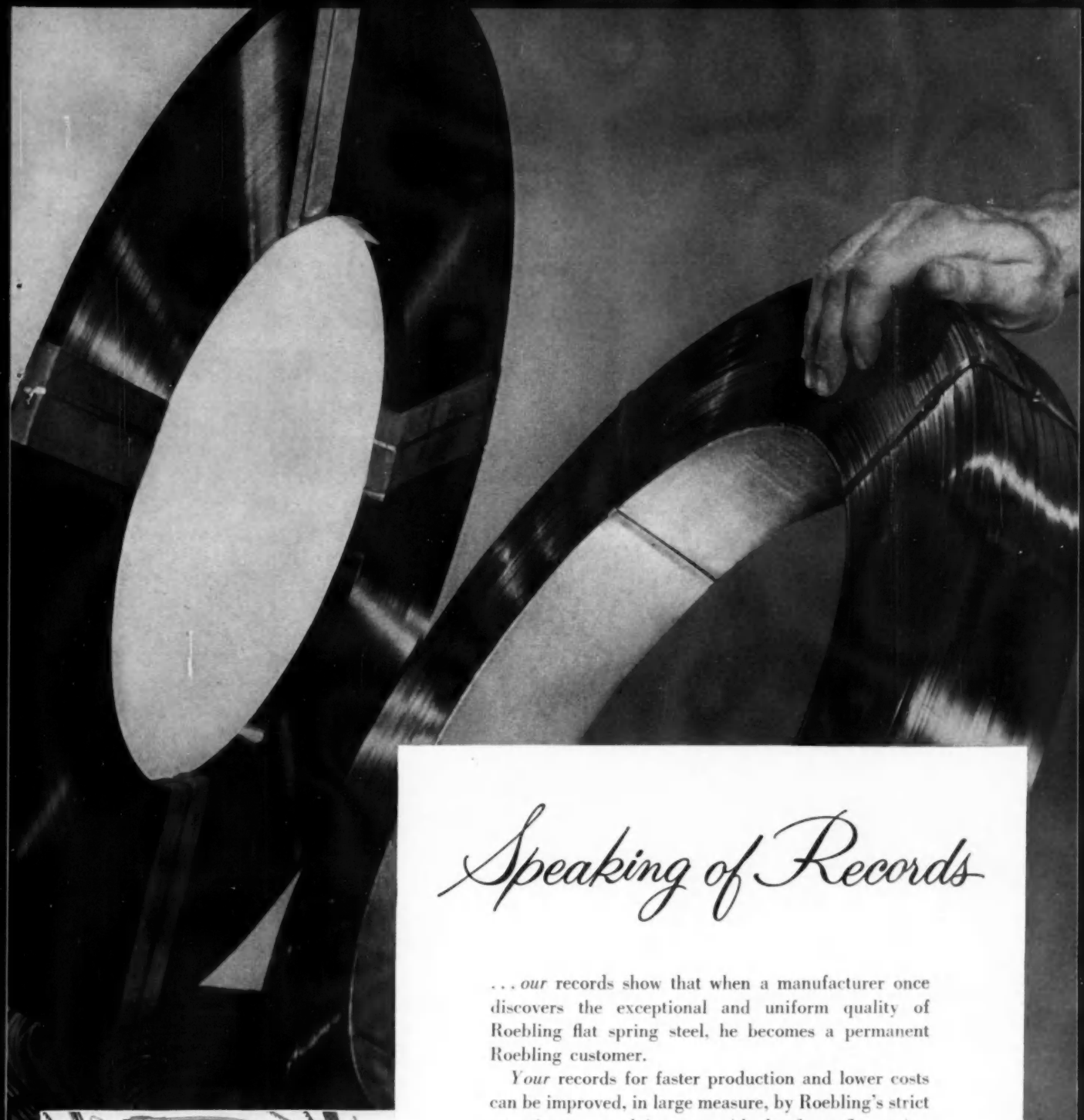

Speaking of Records

. . . *our* records show that when a manufacturer once discovers the exceptional and uniform quality of Roebling flat spring steel, he becomes a permanent Roebling customer.

Your records for faster production and lower costs can be improved, in large measure, by Roebling's strict attention to supplying you with the finest flat spring steel available. When you need flat spring steel, specify Roebling. Write Roebling's, Wire and Cold Rolled Steel Products Division, Trenton 2, New Jersey, for complete details.

These are typical of the many types of quality parts produced from Roebling flat spring steel.

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Roebling... Your Product is Better for it

HYPALON®
SYNTHETIC RUBBER

...the best answer to many automotive design problems

HYPALON synthetic rubber provides qualities not available in conventional elastomers for automotive design problems. HYPALON can be compounded to give a completely ozone-proof and color-stable elastomer with excellent weather, abrasion, oil and heat resistance.

This unique combination of properties has made HYPALON the choice of many design engineers for a variety of automotive applications—ignition cables, spark plug boots, coatings for door and deck lid seals, coatings for headliners, replacement convertible tops, and for white tire sidewalls.

Investigate the design advantages of HYPALON. It is currently being used for coating fabrics, for molded and extruded goods and for solution coatings in a range of nonstaining colors. For more information, call your rubber supplier or write E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department AI-6, Wilmington 98, Delaware.

DU PONT

HYPALON®
SYNTHETIC RUBBER

Better Things for Better Living . . . *through Chemistry*

NEWS

Vol. 124, No. 11

June 1, 1961

Wall St. Trends Forecast Further Automotive Gains

By Hartley W. Barclay, Editor and Publisher, and C. B. Campbell, News Editor

Trends of automotive stocks for 31 market leaders analyzed quarterly by AUTOMOTIVE INDUSTRIES show reflections of expectations of further improvement in financial performance. Continuing the analysis of publicly held securities reported on previously in this magazine, the comparison of market performances through mid-May, 1961, shows these issues reflected the following aspects:

1. During the period from Feb. 1, through mid-May, 70.9 per cent of the securities advanced. There was a $3.35 average gain on all 31 stocks during this period. There was a 19.5 per cent gain on the best four upward performances. There was a 10 per cent loss on the average performance of the four stocks which receded in price. Two issues were unchanged.

Only One Declined

2. During the period from mid-August, 1960, through mid-May, 1961, all except one of the issues advanced, or were unchanged, while one declined. The loss on this one issue was less than one per cent. In brief, on random investments in these 31 issues, there was a 30 to 1 chance that any investment would have been profitable for the investor, or at worst, would not have resulted in a loss of invested capital. The best possible performance among these securities would have been choice of one issue which gained 60 per cent.

3. Review of the longer range trend of these securities, shows that the trend of market prices reached a bottom and started a broad upward movement in February. This leads analysts to the opinion that holders of these se-

ENGLISH FORD'S NEW CONSUL 315

Back-angled rear window trailed by 21 cu ft of overhanging trunk feature this new model. It is powered by a long-stroke adaptation of the Anglia engine with displacement increased to 81.78 cu in. and output to 56.5 hp at 5000 rpm. Built on a 99-in. wheelbase, the Consul 315 is 14 ft 2¼ in. long, five ft. 5¼ in. wide and four ft. 6½ in. high.

curities had pretty much discounted the 1961 business recession as early as mid-1960.

Typical large gains made since February on single issues included such spectacular performance as increases, respectively, of 18⅛, 14⅜, 14, and 13⅛ on certain individual issues. Losses ranged from a maximum of 7⅞ on one issue and 4¼ on another, to merely fractional losses of as little as ⅞ on a third and ⅛ on a fourth issue. An investor buying all 31 issues would have gained substantially on his overall investment, despite losses on stocks which receded since February.

Spectacular Performance

This performance is considered quite spectacular by investment analysts, because the automotive market has generally been described as lagging far behind the general trends of industry during the first half of 1961. With most of the adverse conditions well discounted, analysts point out, the automotive field has shown less than the sharp speculative advances typical of many other securities categories during the recent renewal of the 1961 bull market. Therefore, it is expected that any sell-off or major set-back on a general selling wave will hit the automotive issues with less impact than some of the much more popular market favorites.

Improvement Likely

Reports of individual earnings positions of individual companies in this group have not been available in any official form, except for the published results of first-quarter earnings or losses. Since these have been quite adverse for some companies, the reflection of such situations has tended to hold back the entire automotive list. However, such statements have not reflected the important and substantial reductions in costs which have been made by almost all companies in these industries. In studying these financial trends, therefore, there is considerable evidence that improved operating statements will result from the second quarter, possibly continuing through the third quarter.

It was pointed out in previous reports that the market trends of 1960 for these securities tended to foreshadow the reduced earnings of the last quarter of 1960 and the first quarter of 1961. The strong and steady, but moderate general advance in these securities during the first half of 1961 can be interpreted as pointing toward a second half of 1961 stronger than the first half. It can not be determined at this time whether these trends also definitely point toward a stronger 1962 although such a situation would not surprise the industry.

Strongest Sub-Division

The performance of a number of auto parts producers' securities has marked this sector of the field as one of the strongest areas from the standpoint of the confidence of investors. Many of these firms had eliminated or revised operations in "loss divisions or departments" during the first four months of 1961. Others have reorganized operations, changed their product "mix," introduced new and more profitable lines, or added profitable diversifications, it was reported. Now, with substantially higher volume and profits in sight for the second half, for such firms, investors' confidence is reported to have been greatly improved.

The major farm equipment producers included in this list have also shown advances in operations as compared with 1960, and a strong tone has continued throughout the construction equipment and truck industries. Ample increases in military vehicle contracts for

ELECTRIC CAR'S LINES HIDDEN

The Voltaram, experimental battery-operated car produced by Stuart Motors, Inc., of Kalamazoo, Mich., is 52 in. wide, 138 in. long, has done 45 mph and travels 50 mi on an overnight charge of its batteries. Its developers hope to reveal their first production model within a few weeks.

some producers on the list, have firmed up this portion of their total bookings for 1961. More military vehicle contracts are expected during the second half of 1961.

A comparison of this data with recommendations of typical investment analysis firms' data, shows that the latter organizations seem even more optimistic about the future of market prices for these automotive securities. A typical large and conservative firm recommends 28 out of the 31 securities for retention and speculative advances. While AI makes no recommendation, it can be stated that at mid-year 1961, the trend of market prices in automotive securities seems to show much more confidence among securities investors than was typical at the same time in 1960.

Automated Forging Doubles Production

Track links for crawler tractors are being produced at AmForge Div. of American Brake Shoe Co., Pullman, Ill., in a fully automated forging system that will more than double the production rate.

The new system, developed by AmForge, is probably the first of its kind in the forging industry.

It consists of a gas-fired furnace for heating billets; transporting equipment for conveying the hot billets from the furnace to the forging press, and the pneumatic forging press in which is mounted a four-stage die through which the billet progresses to final trim operations.

Ford Styling Head

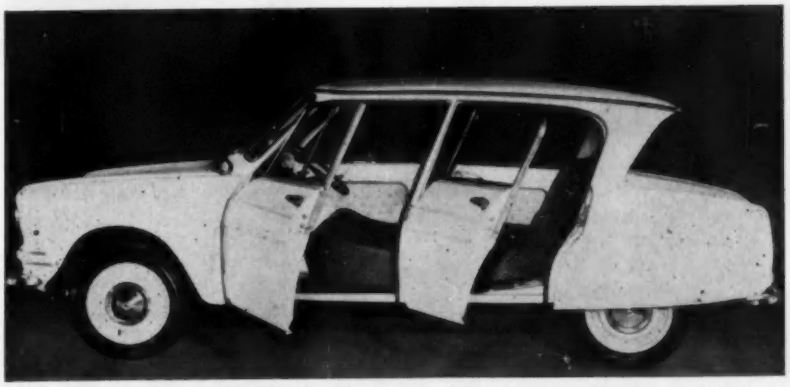
Election of Eugene Bordinat, Jr., as a vice president and director of styling of Ford Motor Co. was announced by William C. Ford, company vice president.

Thus, Mr. Bordinat, who has been chief stylist of the Lincoln-Mercury studio since 1958, assumes the position of retired vice president George W. Walker.

Mr. Bordinat entered the automotive field as a stylist with General Motors in 1939 and became a supervisor of the tank program at the Fisher Body Plant in 1942.

Upon his release from the Army Air Force after World War II, he returned to General Motors as a senior designer. He joined Ford in August, 1947, as supervisor of advanced styling. Since that time, he has been supervisor of exterior styling, manager of Lincoln-Mercury styling, and chief stylist in the Mercury studio.

CITROEN'S NEW AMI 6



The Ami 6, baby sister of the DS 19, stresses passenger comfort with four doors and contoured seats. Low-drag body has reverse slope rear window and raked windshield. The engine is an opposed twin developing 18 hp.

Ford Glass Output

Ford Motor Co. is stepping up its programs in glass research and marketing, Henry Ford II, board chairman, revealed. He spoke at ceremonies marking the lighting of a new sheet glass furnace at Ford's Nashville, Tenn., glass plant.

NEWS

CONTINUED

Egbert Optimistic on 10-Year Outlook; Predicts 2.8 Pct. Annual Sales Increase

An optimistic 10-year outlook for the automobile industry was stressed by Sherwood H. Egbert, Studebaker-Packard Corp. president, at the National Industrial Conference Board's domestic business outlook panel in New York.

"The industry as a whole looks for an annual 2.8 per cent increment in sales through 1970," he noted. "It may be more one year and less the next, but the average is expected to be relatively constant because it is based upon population and income growth, scrappage and replacement."

Mr. Egbert said strong indications of a general upturn in business were now appearing, and auto manufacturers were reporting steadily increasing daily order rates. Studebaker's average daily order rate in April was 38.9 per cent over March, he revealed.

Consumers Confident

"I think sales are going up because the vast majority of people who maintained full income throughout this short recession now are wondering what they were worried about."

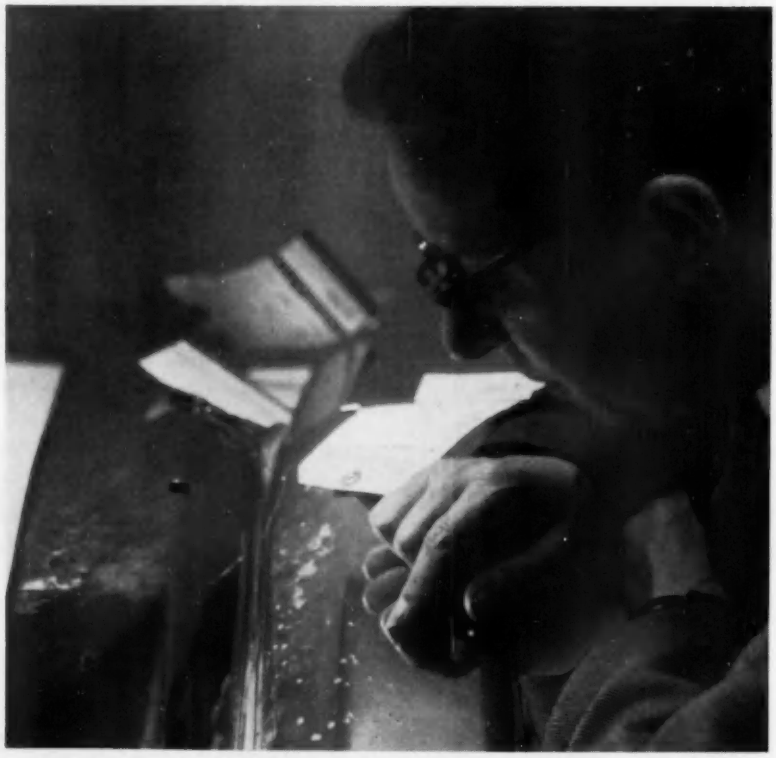
Mr. Egbert predicted that total retail new automobile sales in 1961, including domestic and imports, should reach the area of six million units. This compares with 6.5 million new car registrations in 1960, and six million in 1959.

"The strongest factor favoring increased sales is the rapid build-up of replacement demand, currently one million units more annually than just three years ago," Mr. Egbert continued. "This figure, when taken with requirements for cars by new family formations and the growing trend toward two-car families, virtually assures an annual sales demand of around six million units."

With the market outlook indicating increased sales, especially in the latter half of the third quarter and in the fourth quarter, Mr. Egbert said the industry should expect an orderly clean-up of 1961 models and a stimulated sales introduction of 1962 models this fall.

"As for our own company," Mr. Egbert concluded, "I am certain that the new efforts, ideas and product development in Studebaker today, coupled with an upturn in the economy most of us predict, will provide Studebaker with the share of the market we need to turn investment into earnings, and earnings into research and expansion for the corporation's unlimited future."

SHOTGUN TEST FOR BUMPERS



Effects of road gravel striking steel and aluminum automobile bumpers are demonstrated by shotgun test. To simulate effect of particles being thrown by tires of car traveling at high speed, one charge was fired at both type bumpers from .12 gauge shotgun at 20 yds. Aluminum bumper was dented and severely pock-marked. Steel bumper was undented, slightly pock-marked. C. L. Altenburger, technical assistant, Great Lakes Steel Corp., inspects test bumpers.

B.F.Goodrich

New way to protect your metal product... a temporary but tough coat of Geon

Panels for this building were coated and fabricated by Elwin G. Smith Company, Pittsburgh, using "Strip-Gard" strippable vinyl coating made with Geon vinyl by Stoner-Mudge Company, Pittsburgh, a Division of American-Marietta Company. It can be applied by all standard methods including brush, reverse roll, spray, dip, flow and conventional roll coating. B.F.Goodrich Chemical Company supplies the Geon vinyl.

Here's a temporary coating that goes on metal fast, strips off easily. Meanwhile, it gives polished, embossed or coated metals protection during fabrication, storage and shipping. It's an organosol based on Geon vinyl.

Since the coating stretches well and is very flexible, you can corrugate, emboss, roll-form or draw metals coated with it without affecting the coating. In some cases, it eliminates the need for lubrication. Wear on expensive plated or polished dies is significantly reduced. And there's no need for final cleanup after fabrication or assembly.

Because it's made of Geon, the coating protects metals from the effects of oil, grease and from discoloration or etching of corrosive chemicals. It provides excellent resistance to scratching or abrasion. The manufacturer says it's not designed to protect against weathering, but it will—tests show no staining or embrittlement outdoors for periods up to six months. And the desirable stripping qualities are not impaired.

Here's another way that Geon vinyl is opening new markets, making possible new or improved products. Want more information? Write Department NP-3, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

B.F.Goodrich Chemical

a division of The B.F.Goodrich Company

Geon VINYLS

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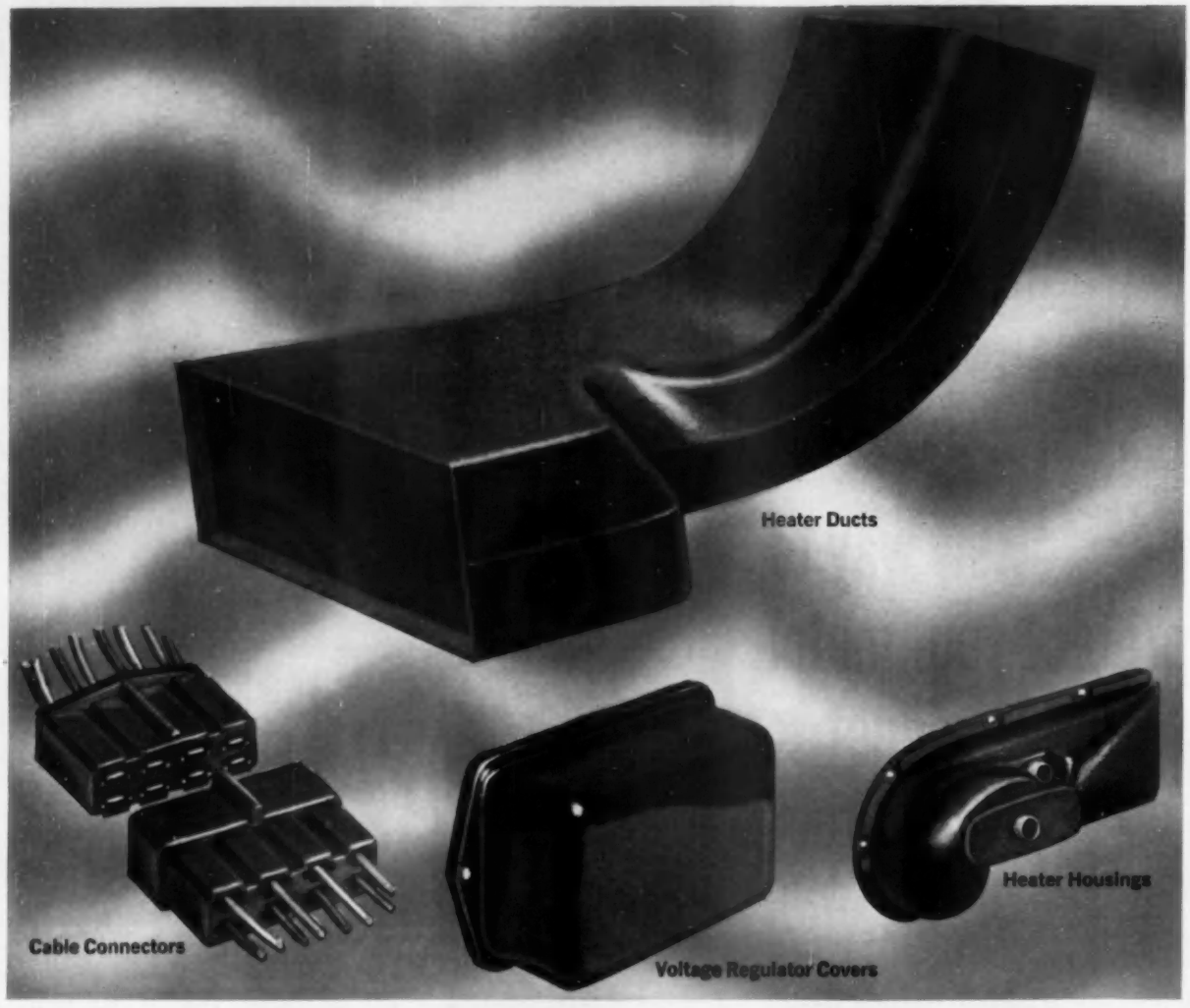
What's News in Plastics...



Long term heat aging stability

Yours with new Escon® 125 molding grade polypropylene!

Automotive applications are a "natural" for new Escon 125 polypropylene. This outstanding new grade is designed especially to maximize performance for long periods at high temperatures. Exceptional performance is achieved through a special LTHA (Long Term Heat Aging) stabilization system developed by Enjay research affiliates.

Escon 125 offers oxidative stability that, in carefully conducted laboratory tests against other commercially available grades of polypropylene designed for this type of service, outperformed all others tested. Specimens of Escon 125 withstood almost three months of oxidative aging at 300°F; specimens exposed to 250°F have shown no signs of failure after seven months. Melt index is 5.5 at 230°C. No changes are required in equipment, processing conditions or coloring techniques from those used with general purpose molding grades. For test samples and typical properties of new Escon 125, write to Enjay, 15 W. 51st St., New York 19, N.Y.

EXCITING NEW PRODUCTS THROUGH PETRO-CHEMISTRY

ENJAY CHEMICAL COMPANY

A DIVISION OF HUMBLE OIL & REFINING COMPANY

ENJAY PLASTICS

Circle 119 on Inquiry Card for more data

NEWS

FEATURES

50 Pct. More MPG?

Ford Aide Explains New Type Engine

Fifty percent more gasoline mileage for automobiles will be a reality in less than 10 years, Victor G. Raviolo, executive director of the Ford Motor Co. Engineering Staff, told an American Petroleum Institute meeting in Houston, Tex.

Mr. Raviolo said the greater mileage will result from "stratified charge" engines using a variation of the fuel injection principle. A highly efficient chemical mixture, including optimum amount of oxygen, would be fired in a pre-combustion chamber.

Ignites Main Charge

This, in turn, he explained, would touch off the main fuel charge, a lean fuel mixture, in the regular combustion chamber.

Mr. Raviolo declared, however, the new process is likely to be expensive, at least when it is first marketed. Fuel injection, sparingly used now, also has a high cost label.

The new engine, Mr. Raviolo predicted, "will come about no sooner than five years but not later than 10 years from now." Because of the cost, he added, it might be an extra-cost option for several years.

At another American Petroleum Institute meeting in Detroit, Paul C. Ackerman, Chrysler Corp. vice president - engineering, said the self-satisfied driver was a high accident potential.

5 Years Between

"It isn't surprising," he declared, "that we become self-satisfied about our driving ability since average drivers travel approximately 42,000 miles—or five years—between property-damage accidents.

"Self - satisfaction about our driving ability is, in my opinion, one of the principal causes of motor vehicle accidents. It has the effect of encouraging you and me, and others like us, to overestimate our ability to keep our cars under control in an emergency.

"The plain, hard facts are," he declared, "that the majority of injury-producing accidents are caused by self-acknowledged good drivers traveling at speeds under 50 miles an hour."

DODGE'S NEW MOBILE HOME

Latest innovation in the camping-traveling field is motorized home by Frank Motor Homes, Inc., Brown City, Mich. Built on Dodge truck chassis, it's powered by a 200-hp engine with automatic transmission. It is available in 20, 23 and 26 ft. lengths. The interior ceiling height is six ft. three in.

AI TABLOID

A chemical additive in jet fuel has proved more efficient than heaters in preventing stoppage of flow by the formation of ice at high altitudes.

* * *

Research to develop design criteria for anti-friction airframe bearings for use in air and space vehicles is described in one of four Air Force reports.

* * *

A new device repairs punctures and inflates auto tires at one time and requires no jacking up of the car—based on butyl latex and compressed air in an aerosol type container.

* * *

The preparation, fabrication, and properties of intermetallic compounds for high temperature service are described in one of three research reports on materials suitable for high temperature applications.

* * *

A new smog burner employs a catalyst to reduce constituents in automobile exhaust believed responsible for smog.

* * *

The most effective x-ray machine will see through a foot of steel to give photographic proof of soundness or flaws. It employs eight million electron volts.

* * *

A handbook designed to provide research engineers and metallurgists with complete data on the room temperature fatigue properties of structural materials has been compiled by the Air Force. It gives fatigue information on steels and heat resistant alloys, and aluminum, magnesium and titanium alloys.

* * *

The part played by environmental and atmospheric conditions in determining the application of various metals as space vehicle components is investigated in a report released to science and industry. Another report gives a summary of data on titanium-alloy forgings.

Important contributions to the technology of encapsulating electrical components in polymeric casting resins are summarized in a PLASTEC research report. It discusses major contributions to this specialized field by manufacturers of resins, mixing- and dispensing equipment, and electrical equipment.

* * *

A universal fuel—capable of satisfying the potential requirements of land, sea, and air transport—and creation of an engine for operation on such a fuel are discussed in one of two translations of Russian mechanical literature.

* * *

Acrylic resin emulsions make floor polishes that do not discolor with age to change pastel shades of floor coverings.

* * *

Fog automatically produced in seconds after a fire is detected by a sensing device is the latest in fire fighting methods of the petroleum industry.

* * *

A new flexible pipe made from high density polyethylene resin is bidding strongly for places in sprinkler systems, potable water lines, farm water systems and jet wells.

* * *

Refined copper production in the United States in 1960 set a record —1.8 million tons—while exports of 435,000 short tons were the highest in more than 30 years.

* * *

An improved DC current interrupter developed by the Navy as an aid to electrochemical studies is described in a research report released to industry and the public.

* * *

Progress in military fuel cell research and development is reviewed in an Army report released to industry and the public. The report, second in a series, covers the period from June, 1959, to date.

Firestone's new passenger tires will have a tread pattern on the inside as well as the outside. It is the result of a new curing process that eliminates the possibility of air being trapped in the cord body of the tire during curing.

Metal Outlook

The importance of the automotive industry in the metal marketing picture was stressed by Richard J. Lund, assistant technical director, Battelle Memorial Institute, in an address before the Society of Automotive Engineers.

Mr. Lund pointed out that in 1959 automobile, truck and bus manufacturers took about 20 per cent of U. S. steel consumption, 16 per cent of the stainless, 48 per cent of the malleable iron, eight per cent of the aluminum, 10 per cent of the copper, 12 per cent of the lead, 30 per cent of the zinc and some 20 per cent of the nickel output.

He predicted the industry would have a plentiful supply of metals during the next 10 years unless foreign developments changed the present picture.

Automation and Safety

Automation has contributed greatly to industrial safety, Robert T. Ross, of Ford Motor Co.'s Industrial Relations Staff, told conferees at the annual Central Indiana Safety Conference and Exhibit.

Mr. Ross said installation of automation equipment has been a significant factor in an 86 per cent reduction in disabling injuries at Ford plants since 1947.

He warned, however, that installation of automation equipment must be accompanied by aggressive, conscious safety programs, including instruction, demonstration and practice in the operation of new equipment.

Automation will be used in automobile transportation of the future, in proximity warning systems, automatic signal systems, televised traffic control and other systems for highway safety, Mr. Ross predicted.

Welding Exposition

Sales were brisk and interest was high at the 42nd Annual Meeting and Exposition of the American Welding Society in New York City. More than 19,000 attended the five-day meeting.

The interesting program was credited with attracting the record attendance.

The Commodore Hotel was the scene of 22 technical sessions, reading of 72 papers, and the annual banquet.

One hundred and 20 manufacturers and suppliers displayed more than $3 million worth of new equipment at the New York Coliseum. Manufacturers attracted large throngs to their exhibits with demonstrations of latest techniques.

A-C Sees Improvement

Allis-Chalmers Manufacturing Co. expects improved results as the year progresses, R. S. Stevenson, president, said at the firm's annual meeting.

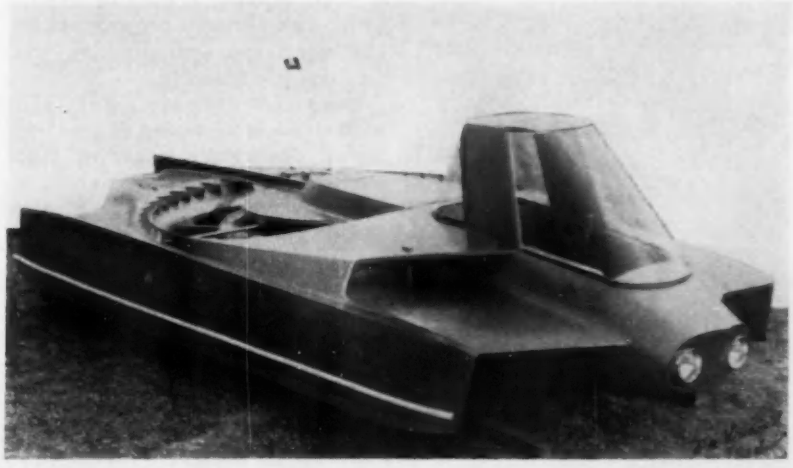
Mr. Stevenson said retail sales of farm equipment began to improve during the first quarter and at the end of that period were running about 10 per cent better than the same period in 1960. In addition, dealers were showing their optimism by buying more goods.

He said that highway contract outlays were being substantially increased and would be the basis for larger construction machinery sales throughout the balance of the year. He added, however, that as yet construction machinery sales were showing no visible signs of improvement.

Reliability Institute

The University of Connecticut will hold a Reliability Engineering and Management Institute from June 11 to June 23. It is sponsored by the New England Sections of the American Society for Quality Control and the School of Business Administration, University of Connecticut.

AEROMOBILE EXHIBITED IN JAPAN



Seeking a way to reach rural patients over snow-clogged or muddy roads, Dr. William R. Bertelsen, of Neponset, Ill., came up with this Ground Effect Machine. It weighs 1700 lb, is 17 ft, 7¾ in. long and is 96 in. wide. For power, it uses a 200 hp engine and consumes seven gallons of fuel per hour. The Aeromobile, recently exhibited at Tokyo trade fair, can do 60 mph.

Russian 12-Station Automatic Transfer Line For ZIL Truck Oil Filter Housings

An interesting machine tool exhibit inspected recently in East Germany was a Russian 12-station automatic transfer line. Designed for machining oil filter housings for the ZIL truck engine, its most unusual feature was an offset station to permit tapping the work on four different faces simultaneously.

A spur section of transfer rails, at right angles to the main line, conveys the loaded platen to this position during the normal operating sequence.

Light Alloy Casting

At the start of the line the light alloy casting is manually loaded in the platen-borne fixture and mechanically clamped by a motor-driven dog clutch. Opposed faces are milled by separate heads at the first work station, where the travelling milling head on the left side of the line engages the transfer bar at the end of its pass and advances the work on its fast-return.

Tooling for the next two stations is duplexed on common slides, with three holes drilled on one side of the line and an oil passage bored and counter-bored on the other. Three stations are combined on the next pair of heads, with successive deep-hole drillings on the left, and two-stage boring of the filter element housing seat on the right, followed by an inspection probe.

Turned 90 Degrees

Then comes further boring and drilling at a single station, after which the platen is elevated, turned 90 deg, and returned to the track so that the alternate sides of the casting can be bored and faced at the subsequent two stations which are spanned by a pair of opposed heads.

The platen is now turned 90 deg again prior to reaching the departure point for tapping. Here it is raised slightly off the main track by a hydraulic lifter, then engaged by the transverse transfer bar that draws it sideways along the spur track. This bar is actuated by a hydraulic cylinder geared through a rack and pinion to lengthen the effective stroke.

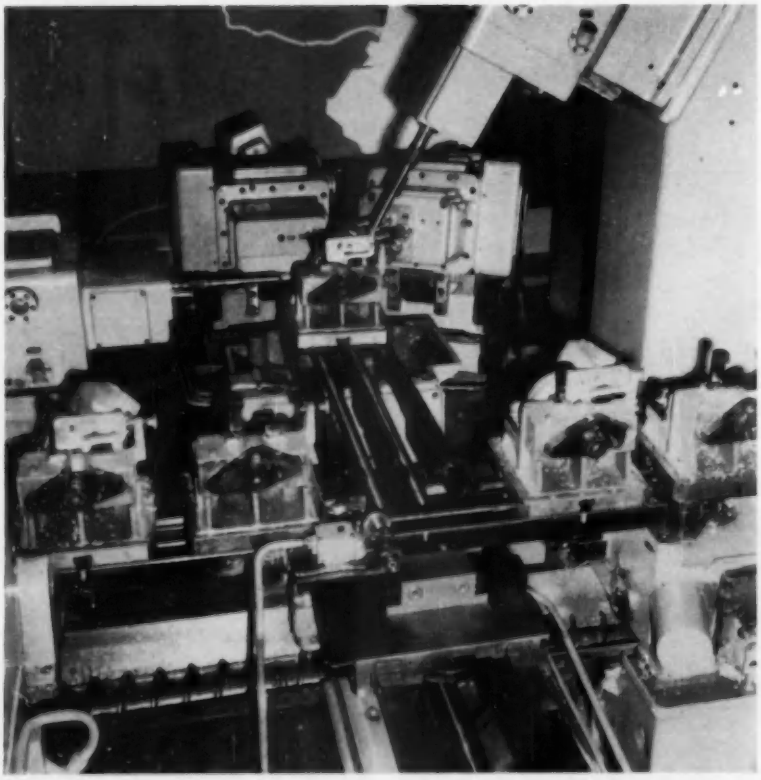
Work is clamped downward from beneath the rails at the end of the short track section, and the four tapping heads feed in.

Cleared of Chips

When the platen returns to the line the work is cleared of internal chips at the final station which incorporates a hydraulic shake-out mechanism. The entire platen is lifted off the line by a pivoting arm that tilts it to vertical, rocking it vigorously within an enclosing cabinet while the interior is sprayed with a washing agent. Chips fall through the cabinet to the worm conveyor running the full length of the line.

Completed work leaving the end of the line is advanced to the first leg of the return conveyor that carries the platen rearwards to the elevator feeding the long track behind the line, which is dropped to a low level to ease access to the inside machines. A second elevator delivers the platen up to the final conveyor leg that takes it to the load/unload position.

The transfer line has a total of 41 platens in circulation, and operates on a one-minute cycle time. It was designed and built at the Ordzhonikidze Machine Tool Factory and is scheduled for installation at the ZIL plant in Moscow.



Spur rails at right angles to main track carry the platen sideways to the offset tapping station where four faces are exposed for simultaneous working.

Corrosion Protection

After elaborate studies, Ford Motor Co. chose galvanized steel for critical areas on its bodies, John C. Widman, executive engineer, Metal Stamping Div., told the American Zinc Institute.

Ford's Falcon became the first car to use substantial amounts of galvanized steel, he declared. Since that time, all Ford passenger cars and some trucks have incorporated some galvanized steel in their structures, and most manufacturers are now, or will be, using the material.

Explains Reasons

The increased use of unitized construction, more demand for lighter colored exterior paints, and more salt on city streets in winter were the main reasons for the change, Mr. Widman declared.

In planning the Falcon, Ford engineers considered many methods of corrosion protection for the unitized structure, including various organic coatings, steel alloys, metallic coatings, and some unusual methods. The choice narrowed down to hot dipped galvanized steel.

First Tries Discouraging

First attempts to weld the material were discouraging. Results were improved with differentially coated sheet in which a smaller amount of zinc was used on the weld tip side. Application of a pre-cleaner with steel wool or a wire brush before the phosphate and paint cycle gave adequate adhesion of paint.

Each Lincoln Continental uses 250 lb of galvanized steel, Econoline trucks and buses about 92 lb. and the Thunderbird 213 lb. Ford and Mercury models use lesser amounts. The Lincoln Continental and Thunderbird are dip painted in addition to the use of galvanized steel. Improvements in phosphating treatment now make it unnecessary to use a pre-cleaner and wire treatment for Falcon models.

The differentially coated stock has given way almost completely to equally coated steel due to improved welding techniques.

Mr. Widman said Ford plans increased corrosion protection and called on the Zinc Institute to (1) work toward improved weldability of galvanized steel; (2) control white rust; (3) improve uniformity in coating; (4) improve industry-wide uniformity of galvanized, and (5) reduce costs.

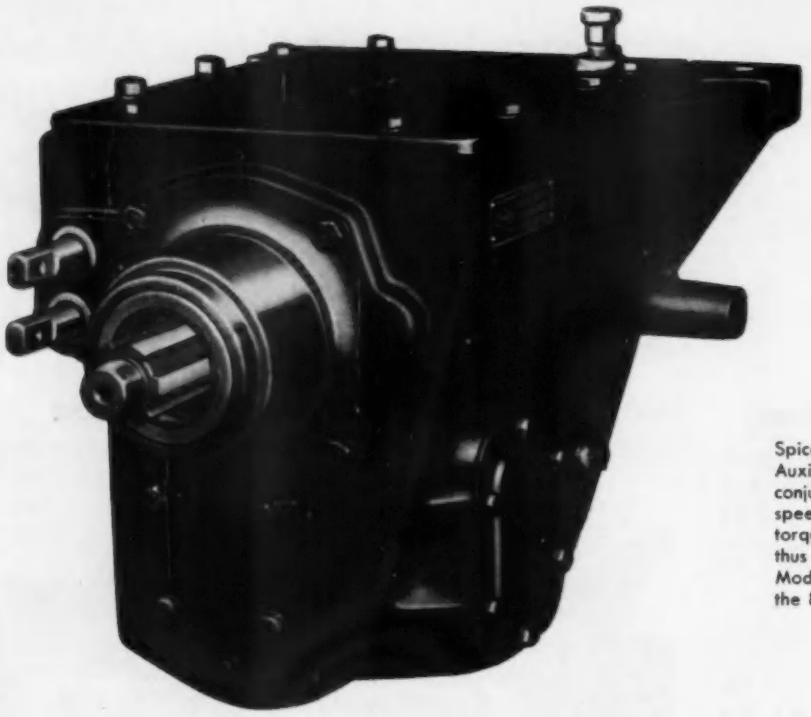
CESSNA'S REVOLUTIONARY BUSINESSMAN'S PLANE

Twin-engine four-passenger Skymaster utilizes an engine on each end of the cabin section. One provides a pulling force and the other pushes the craft.

Tool Engineers' Day

Changing the art of communications into a science is revolutionizing the whole pattern of industry from top to bottom, according to a report presented to representatives of industry at the New Yorker Hotel, New York City, on Tool Engineers' Day, May 1. In preparation for five months, the detailed study, entitled "This Is Tomorrow!" was presented by Athel F. Denham, president, Denham & Co., Detroit industrial advertising agency specializing in industrial communications.

Forcing the change from art to science, he said, is the advent of new communications tools, particularly the new electronic computers. Mr. Denham was awarded the Distinguished Technical Service Award of the New York chapter, American Society of Tool Engineers, following presentation of his report.



Spicer's new Model 7041 4-Speed Auxiliary Transmission—for use in conjunction with standard 4 or 5-speed transmissions—has a nominal torque rating of 550-600 ft. lbs., thus narrows the gap between the Model 6041 (375-400 ft. lbs.) and the 8341 (750-900 ft. lbs.)

New Spicer 4-Speed Auxiliary Transmission For Engines in the 400-600 Ft. Lbs. Torque Range

Model 7041 Broadens Range of Spicer Line, Utilizes Maximum H.P., Is Quiet, Saves Weight

Now—Spicer has added a new model to its power line of 4-speed auxiliary transmissions—the Model 7041—whose 550-600 ft. lbs. nominal torque rating meets a vast need for engines developing over 400 ft. lbs. of torque.

The 7041 operates most effectively with main transmissions in the 400-600 ft. lbs. capacity range. Ratios in the auxiliary are spaced so that they functionally split or compound the ratios of the main transmission.

The new transmission has good splits in the top three gears, as the following table shows:

RATIOS	Model	1st	2nd	3rd	4th
	7041	2.31	1.21	1.00	.83

The result is that it is possible to utilize the maximum horsepower of the engine during shifts. In addition, the driver is able to complete shifts in these three splitter gear positions at the same R.P.M.

The new auxiliary transmission is also constant mesh in all gear positions, which makes for quieter operation and easier shifting due to the use of helical gears throughout. It is lighter and less bulky than any other 4-speed auxiliary transmission of similar capacity.

For complete data on the many advantages of the new Spicer 7041, write to Dana Corporation, Toledo 1, Ohio.

Spicer Top Mount Power Take-Off can readily be assembled to the 7041 Auxiliary Transmission by merely removing the cover, is ideal for operating air compressors, heavy-duty winches, large pumps, and other materials handling devices requiring full engine torque.

DANA Spicer **DANA CORPORATION**

Toledo 1, Ohio

SERVING TRANSPORTATION—Transmissions • Auxiliaries • Universal Joints • Clutches • Propeller Shafts • Power Take-Offs • Torque Converters • Axles • Powr-Lok Differentials • Gear Boxes • Forgings • Stampings • Frames • Railway Drives

Many of these products are manufactured in Canada by Hayes Steel Products Limited, Meritton, Ontario

Circle 120 on Inquiry Card for more data

MEN IN THE NEWS

B. F. Goodrich Tire Co. — Harold J. McCormick has been named advertising and promotion manager.

Dura Corp., Motor State Products Div. — Maxwell M. Wachowiak has been appointed manager.

Crucible Steel Co. of America, Carbon and Alloy Specialties Product. Div. — Bruce O. Young has been appointed manager.

Ford Motor Co., Marketing Staff—Robert J. Fisher has been appointed director of advertising and sales promotion office.

R. C. Mahon Co., Industrial Equipment Div.—Charles M. Hargraves has been promoted to manaager.

General Motors Corp., Central Foundry Div.—Carl A. Koerner (far left) has been appointed works manager and Charles E. Drury has been named director of sales and engineering.

Ford Motor Co., Glass Div.—**Dr. Robert Gardon** has been appointed research manager.

Allis-Chalmers Mfg. Co., Power Equipment Div.—**Roy M. Casper** has been promoted to general manager.

Colorado Fuel and Iron Corp.—**Delbert W. Yarberry** has been promoted to assistant superintendent of the rolling and finishing departments at the Pueblo plant.

Syntron Co.—**William V. Spurlin** has been named vice president and chief engineer.

R. C. Mahon Co.—**Robert C. Palmer** has been elected president and a director.

Dana Corp.—**Robert P. Lewis** has retired as consultant to the vice president-engineering.

Dayton Tire & Rubber Co.—**Frank L. Scales** has been promoted to secretary-treasurer and **Robert L. Girton** has been named factory manager.

Bell Aerosystems Co., Aerospace-Rockets Div.—**J. Carl Moore** has been appointed director of manufacturing.

Bendix Corp., Cleveland Instrument Co.—**F. W. Witzke** has been promoted to vice president and chief administrative officer.

Standard-Thomson Corp., Automotive Div.—**Pierce Hollingsworth** has been named manager of engineering and development.

General Dynamics Corp., Convair Div.—**E. Warren Feddersen** has been named director of manufacturing development.

Dow Chemical Co. — **Myron A. Frank** has been promoted to automotive chemicals product manager.

Ford Motor Co., Ford Div.—**Dr. Seymour Marshak** has been named consumer research manager.

Borg-Warner Corp.—**Douglas Mueller** has been appointed director of public relations and advertising.

Warner Electric Brake & Clutch Co.—**Henry P. DeKeizer** has been named manager-tool control and machine processing.

Electric Autolite Co.—**Dr. Wayne J. Subcasky** has been named laboratory supervisor of fuel cell research and **Dr. Merlyn W. Fogle** has been named senior research scientist.

National Malleable and Steel Castings Co.—**S. Donald Sanders** has been named manager of the Cleveland Works.

Clevite Corp., Cleveland Graphite Bronze Div. — **Frederick P. Salzman** has been appointed executive assistant to the general manager.

General Motors Corp., Central Foundry Div.—**Elmer E. Braun** has been named general manager; **Thomas R. Wiltse** has been promoted to reliability director; **Thomas E. Smith** has been appointed Defiance, O., plant manager, and **Dale W. Wonus** has been named Danville, Ill., plant manager.

Necrology

Henry H. Stuck, 67, retired production control manager for Ford Motor Co., died May 7 in Dearborn, Mich.

Oscar H. Jung, 76, founder and president of the Trico Fuse Mfg. Co., died May 5 in Milwaukee.

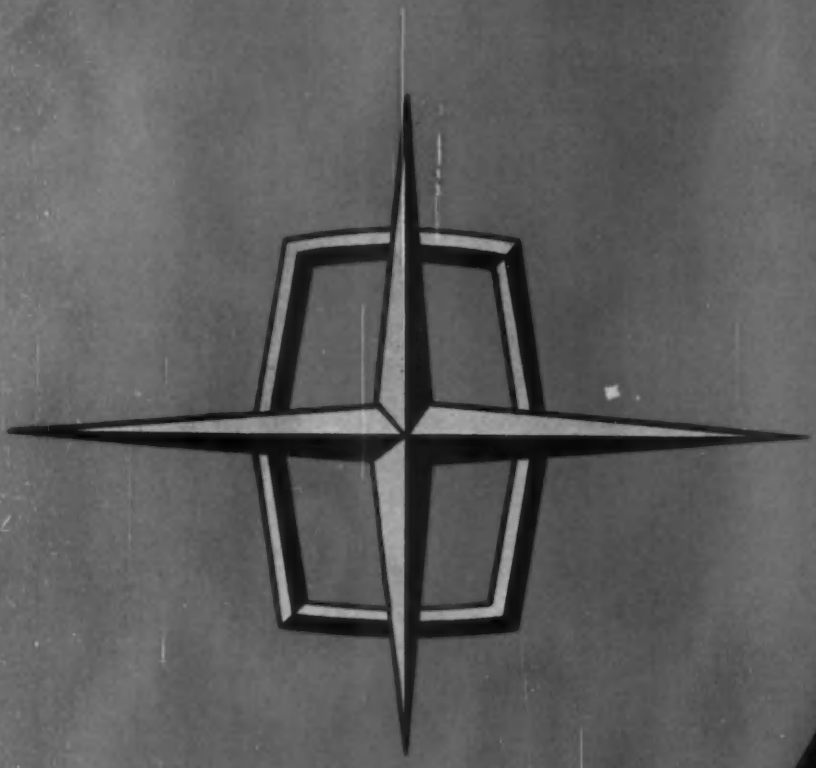
Dallas Winslow, 67, once owner of the defunct Auburn, Cord and Duesenberg auto companies, and president of Mast-Foos Mfg. Co., died May 2 in Detroit.

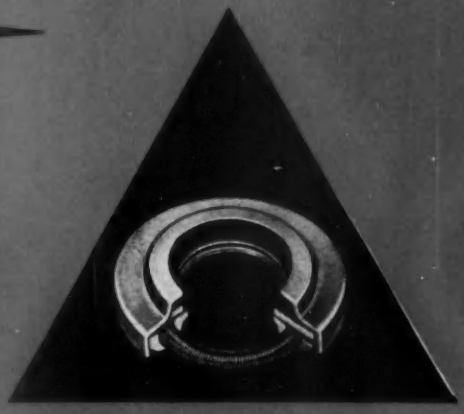
William J. Fiegel, retired chief experimental engineer for the Bohn Aluminum Co., died May 2 in Lockport, N. Y.

Charles P. Betz, 72, retired plant superintendent of the Great Lakes Steel Corp., died May 1 in Fort Lauderdale, Fla.

Lee R. Bryant, 62, production control executive in the car and truck assembly group of Chrysler Corp., died April 29 in Detroit.

Leroy J. Burlingame, 64, corporate attorney and a director of Modine Mfg. Co., died April 21 in Milwaukee.





1961 LINCOLN CONTINENTAL USES THOMPSON ROTOCOIL... FIRST PASSENGER CAR WITH POSITIVE VALVE ROTATION

Behind Lincoln's two year, 24,000 mile warranty lies three years of intensive effort to design, engineer, and produce an engine which will pass the most rigid performance and endurance tests. Lincoln engineers specified Thompson Rotocoils for the exhaust valves, because only through positive valve rotation can you be sure to:

- *Increase valve life many times*
- *Keep valve faces and stems clean*
- *Prevent local hot spots*
- *Reduce valve stem and guide wear*

We are proud of our contribution to this fine American prestige car.

If you are interested in longer valve life and better engine performance, specify Thompson Positive Valve Rotators.

THOMPSON PRODUCTS VALVE DIVISION

Thompson Ramo Wooldridge Inc. • 1455 East 185th Street
Cleveland 10, Ohio

AUTOMOTIVE DIVISIONS

THOMPSON PRODUCTS LIGHT METALS DIVISION | THOMPSON PRODUCTS MICHIGAN DIVISION | THOMPSON PRODUCTS VALVE DIVISION | THOMPSON PRODUCTS RANCO DIVISION | THOMPSON PRODUCTS MOTOR EQUIPMENT MANUFACTURING DIVISION

an Editorial

Facing the Second Half

AT THIS TIME OF THE YEAR, the Automotive Industries of the country review and reappraise the outlook for the future and the trends revealed by experiences of the first half of the year. In total, the outlook is now much brighter than it was at the beginning of the first half. Evidences of real progress are seen in reports on passenger cars, trucks, farm equipment, engines, military vehicles and all other areas vital to the total output of this entire field. It is expected that the adverse financial results reported after the closing of the first quarter will be partially offset by improved financial results during the second quarter.

ALMOST ALL COMPANIES have cut back unprofitable product lines, reduced operating costs, trimmed non-productive overhead and developed plans for more and better products produced more efficiently. Substantial plans have been developed in many plants for improved manufacturing methods. Looking ahead to 1963, the industry has evolved improved programs of research and development, and it is generally expected that 1962 production will increase substantially over 1961 totals. Automotive parts manufacturers anticipate a strong two-year up-trend in production and sales, accompanied by improved profits.

BUSINESS POLICIES ARE BEING ADJUSTED to this new outlook. Buying is being stepped up, particularly in the fields of purchases in which longer delivery dates are expected to prevail during the last half of the year. The underlying forces for economic expansion are strong. Probably the most significant development of the recession period was the trend of the automotive products makers to ask suppliers to cooperate more closely in meeting quality and "reliability" standards. While many suppliers have cooperated on these programs, an even greater number are expected to align themselves with these techniques during the next six months. There has been no previous time in the industry when suppliers have had an equally important opportunity to present, in the most effective way, the entire facts about their facilities, products, engineering and technology, and total capabilities.

Hartley W Barclay

Editor and Publisher

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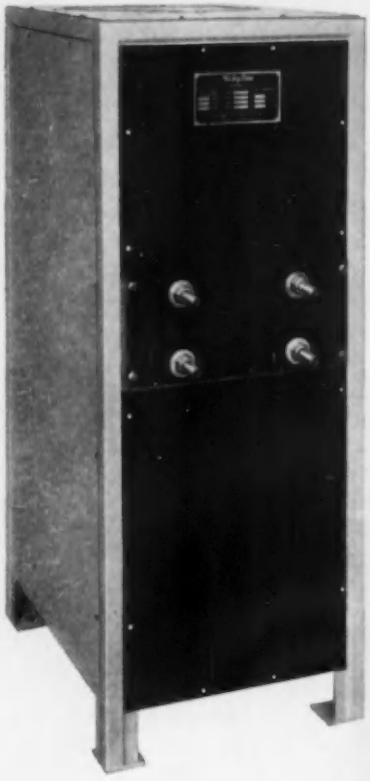

take advantage of the

NEW PROJECT ALERT RECTIFIER PROGRAM

Rebuild your old equipment now!

Now's the right time to let Udylite electrical equipment specialists rebuild your old, inefficient, 6-, 9- and 12-volt UM and UV rectifiers. You can obtain all of the advantages of a completely new silicon unit at a cost just slightly more than a silicon diode replacement kit. With the exception of the transformer, you'll have *a brand new rectifier from top to bottom.*

NEW, MODERN CABINET features slotted side panels for easy removal and replacement.

UNIFRAME CONSTRUCTION gives increased ruggedness, reduces overall weight.

NEW DIODE ASSEMBLY has newly-designed, one-piece, solid copper, finned heat sink and improved, non-aging silicon diodes with ceramic insulation and individual fuse protection.

NEW VENTILATION SYSTEM with new fan-housing assembly and permanent, built-in baffling assures highest ventilation efficiency.

NEW, LOW HEIGHT saves space. D.C. terminals are located in same relative position, thus new bussing is not required for re-installation.

All transformers are full-load tested before and after re-manufacturing. It will pay you to investigate the many benefits of the Udylite Project Alert factory conversion program today. For conversion of other old-style Udylite Rectifiers to economical silicon units, contact your local Udylite Representative.

SILICON CONVERSION KITS—Udylite Silicon Diode Kits are also available for UV and UM rectifier conversion right in your plant. A specially fabricated heat sink assembly, complete with diodes and fuses, permits fast, easy installation.

Udylite

The Udylite Corporation
Detroit 11, Michigan

udylite

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DEVELOPMENTS IN MACHINE TOOLS VIEWED AT SILVER ANNIVERSARY CONFERENCE

By Charles A. Weinert

EASTERN EDITOR

MANY programmed activities and a heavier-than-usual participation marked the 25th, and Silver Anniversary, Machine Tool Forum sponsored by Westinghouse Electric Corp.

The two-day conference, recently held in Pittsburgh, had an attendance of 410 executives and engineers from 119 different companies. Major automobile companies, machine tool builders, and electrical equipment suppliers, among others, were represented.

In the technical sessions, engineers viewed latest developments in machine tools, as well as in drives, automatic controls, and other machine tool electrical components. Sixteen papers were presented. Subjects included choice of machine tools to suit various production needs, space-saving electrical control panels, and a new crankshaft crankpin-machining lathe. Also, electrical drive and power supply developments, along with a series of discussions about numerical control. As the name "forum" implies, audience participation in the sessions was encouraged by question-and-answer periods following every session.

Guest speakers, very prominent in industry, took part in the extensive program. Mark W. Cresap, Jr., president of Westinghouse; Everett M. Hicks, president of NMTBA and vice-president and general manager, Machine Tool

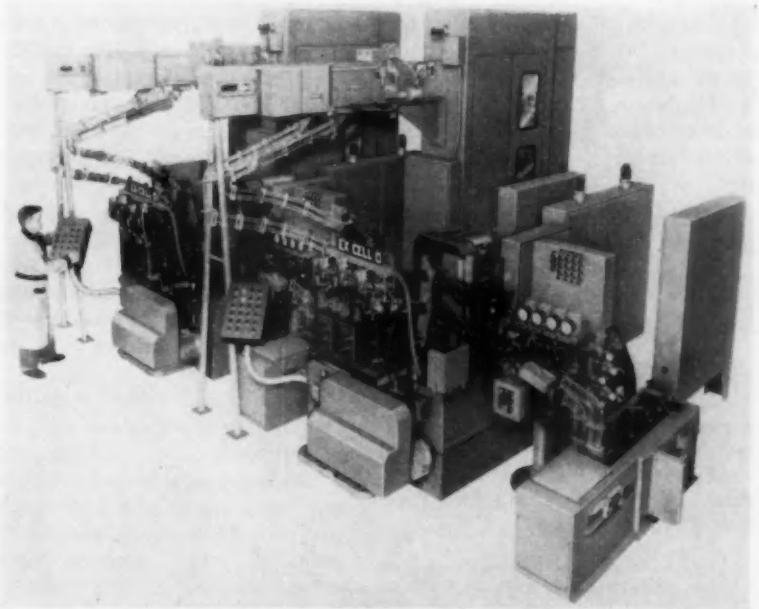


Fig. 1—At Buick, transmission gear blanks are machined all over, prior to cutting of gear teeth, on this Ex-Cell-O automated setup—which has an output of 260 gear blanks per hour

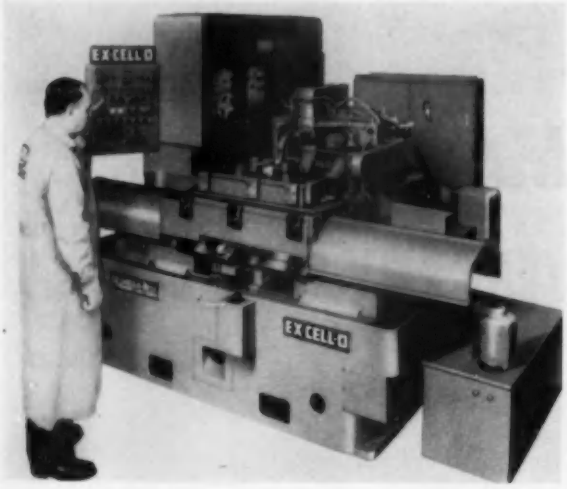


Fig. 2—Ex-Cell-O numerically-controlled machine (left) is versatile; by means of interchangeable assemblies, it can perform various types of work as illustrated below

Fig. 3—Proposed Ex-Cell-O double-end machine (at right, next page) is fitted with tape control, and will handle six different precision boring setups

Div., Norton Co.; and Ludlow King, executive vice-president of the National Machine Tool Builders' Assn., gave timely and high-interesting talks. Their remarks were centered around the lack of sufficient "low-cost capacity" and the need for modernizing U. S. production facilities to meet world competition.

Reports on progress in developing electrical standards also were given by chairmen of committees operating within the NMTBA, EIA, and NEMA.

Another programmed feature consisted of a panel discussion by presidents of three machine tool companies and three officials of Westinghouse. They spoke briefly on different aspects of the "state of the industry"—situations which confront and affect the machine tool industry and its equipment, both here and abroad.

Some of the highlights of the technical sessions are as follows:

Machine Selection

Factors to consider when selecting a machine tool for a particular application, backed up by numerous examples, were explained by R. W. Ford, sales manager, Machine Tool Div., Ex-Cell-O Corp.

The speaker pointed out that while many considerations are entailed, the two major questions are, "What production is required; and what tolerances do you want to hold?" He recounted that accurate parts can be made by a good machinist on any good standard machine—but that to make parts economically in quantity requires a better and different type of machine.

Of particular interest in this talk were the machines cited as application examples. Among these were the following, as described by the speaker:

Gear blanks for Buick transmissions are being machined all over in an automated setup (Fig. 1), prior to cutting the gear teeth. Two cam-type precision boring machines are used, the first holding the parts by the OD while the ID is bored, one side is faced, and the outer edge is chamfered. The second machine grips the ID of the parts, turns the OD, chamfers the outer ID corner, and faces the remaining side. A parts storage and distribution system, gaging and automatic tool adjustment are included in this setup, which produces 260 gear blanks per hour.

For a wide variety of fair-size parts, a standard numerically-controlled machine is available (Fig. 2). Interchangeable assemblies permit precision boring and turning of inside and outside hemispheres, grinding of flat templates and circular cams, and three-axis milling. The slides of this machine are controlled in increments of 25 millionths of an inch, providing exceptionally-high accuracy of work.

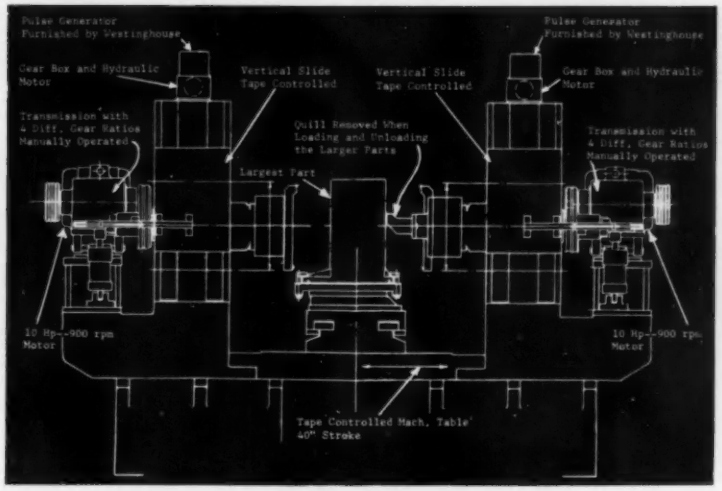
A proposal development worked out between Westinghouse and Ex-Cell-O is the machine shown in Fig. 3. Basically designed around Ex-Cell-O's largest standard precision boring machine, it is a numerically-controlled unit for handling six different precision boring setups. The machine table, cross slide, and vertical spindle slides will be tape-controlled, using the Westinghouse Prodac control system.

Crankshaft Lathe

In a paper entitled "A New Concept in Crankshaft Machining Lathes," Lee M. Boboltz, electrical engineer of The R. K. LeBlond Machine Tool Co., described the functioning of the LeBlond 6-PC single-spindle package pin-turning lathe.

This machine is being offered as the solution to the problem of flexibility in a special-purpose machine. It normally comes with one package tool unit designed for production of a specific crankshaft; but is available with additional package tool units to suit other production needs. Thus, change of the package tool unit provides for manufacture of different size crankshafts on the same basic machine. Or, in case of a design change, a new package tool unit can be ordered for the new crankshaft and substituted for the prior package.

The package tool unit (Fig. 4) is the upper portion of the ma-


Pulse Generator Furnished by Westinghouse
Gear Box and Hydraulic Motor
Vertical Slide Tape Controlled
Vertical Slide Tape Controlled
Pulse Generator Furnished by Westinghouse
Gear Box and Hydraulic Motor
Transmission with 4 Diff. Gear Ratios Manually Operated
Quill Removed When Loading and Unloading the Larger Parts
Largest Part
Transmission with 4 Diff. Gear Ratios Manually Operated
10 Hp--900 rpm Motor
10 Hp--900 rpm Motor
Tape Controlled Mach. Table 40" Stroke

feed rate and final sizing of the crankpin diameter.

Space-Saving Controls

Electrical control panel enclosures, from the standpoint of size, represent a "real problem" to automotive manufacturers using automated equipment. Sometimes they are longer than the machine itself, and run 30, 40 or more feet in length. This was the picture given by John Zambrzycki, Engine Manufacturing Engineering, Engine and Foundry Div., Ford Motor Co. He discussed different approaches to the size problem and some of the answers, including use of "small" relays.

chine, and includes toolholders, tool slides, and master crankshafts. It is constructed for easy removal to facilitate change-over from one type crankshaft to another.

The single-spindle machine is equipped with multiple tools which follow the throw of the crankshaft at every crankpin. It can check and turn all the crankpins simultaneously. The tools for the crankpins are mounted on toolholders that are fastened to large flat plates, or "tool slides" (Fig. 5). The tool slides, in turn, are mounted on the crankpins of two master crankshafts, geared together and to the spindle. Therefore, as the workpiece rotates about its main bearing center, the tool slides have an orbital motion and the tools follow the throws of the crankshaft.

The crankshaft is held in the chucks in proper index by means of previously-milled spots which locate on the chuck pads. The spindles, on which the crankshaft is rotated, are located on the cradle. This entire cradle pivots around the "cradle pivot point" to feed the workpiece into the tools. It is controlled by feed cam rotation, geared to the spindle drive. The shape of the cam surface determines the

Mr. Zambrzycki reported that three types of "small" relays are now on the market and all appear to be promising. One—still on test at Ford and not yet proved—is a plug-in relay in which the panel-mounted socket is front-wired without the relay in place. Another—likewise still undergoing tests—is a throw-away type relay.

The third is a four and eight-pole relay design with a number of contact combinations (Fig. 6). These contact combinations range from all normally-open to all normally-closed on the four-pole ver-

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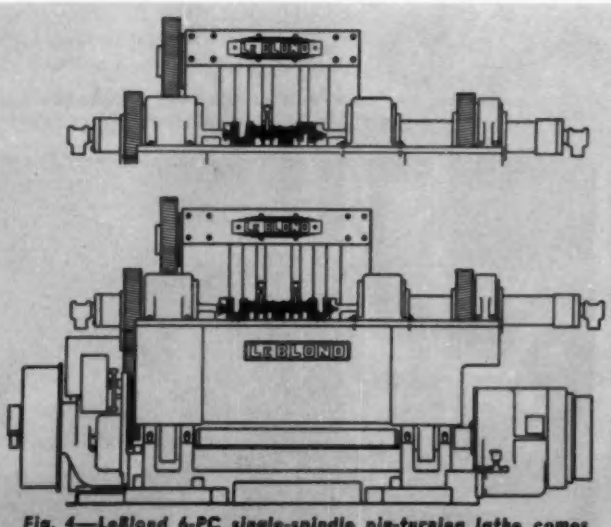


Fig. 4—LeBlond 6-PC single-spindle pin-turning lathe comes with one or more package tool units (top) to match different crankshafts

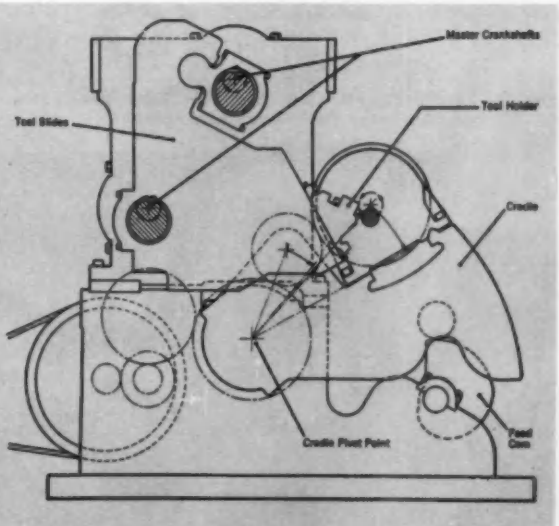


Fig. 5—Schematic of LeBlond 6-PC pin-turning lathe

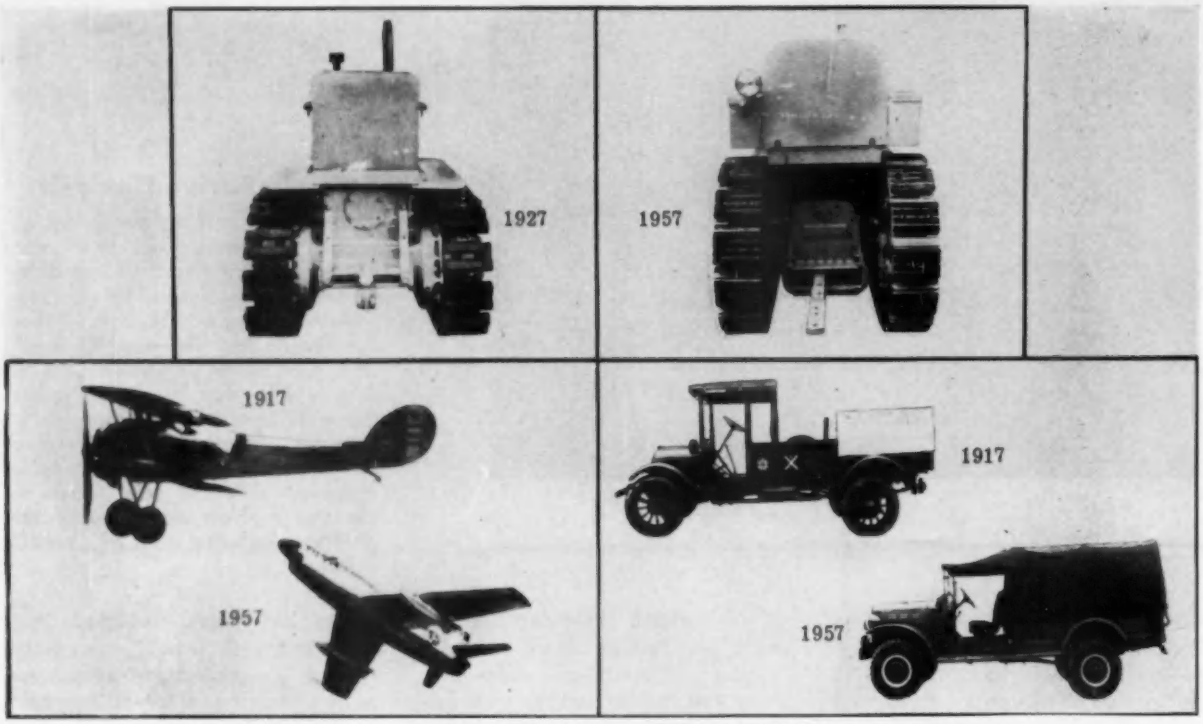


Fig. 1—Form change of motor vehicles between 1917 and 1957 (U.S. Army photograph)

New Clues Toward More Mobility

By Capt. Richard B. Tyler

Land Locomotion Labs Research Div.
Ordnance Tank-Automotive Command
Detroit, Michigan

Some Important New Concepts for Off-Highway Vehicle Design Developed by OTAC

Fig. 2—Land locomotion area at the Land Locomotion Laboratory (U.S. Army photograph)

Fig. 3—Soil test apparatus at the Land Locomotion Laboratory (U. S. Army photograph)

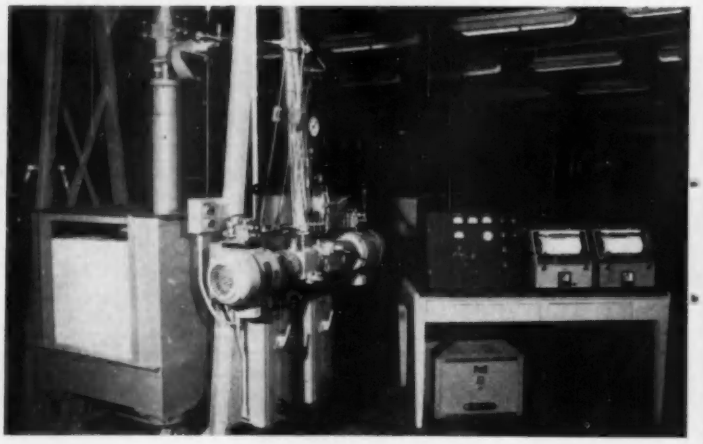


Fig. 6—The Cobra, a preliminary test vehicle

LAND Locomotion Mechanics is a relatively new engineering science; in this country, the first organized effort was begun about 1943, under the pressure of wartime problems. Some work was conducted during the period 1944-1948, but research lagged as a result of the post-war letdown. In 1950, work was resumed in the United States, and in 1954, the Land Locomotion Research Branch was created within the Research and Development Division of the Ordnance Tank-Automotive Command (OTAC) at Detroit. The growing awareness of the importance of land locomotion studies is underlined by the fact that two of the leading commercial manufacturers of off-road automotive equipment have organized their own laboratories, two more are in the process of setting up laboratories, and at least six leading U. S. universities and two European universities have initiated graduate programs in the study of Land Locomotion.

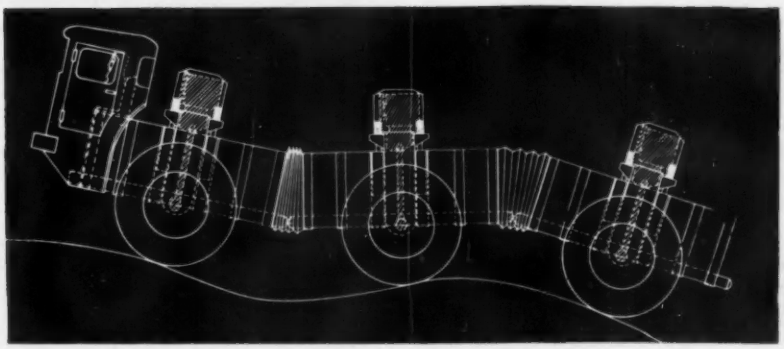


Fig. 5—Land train rough-terrain operation schematic (U.S. Army photograph)

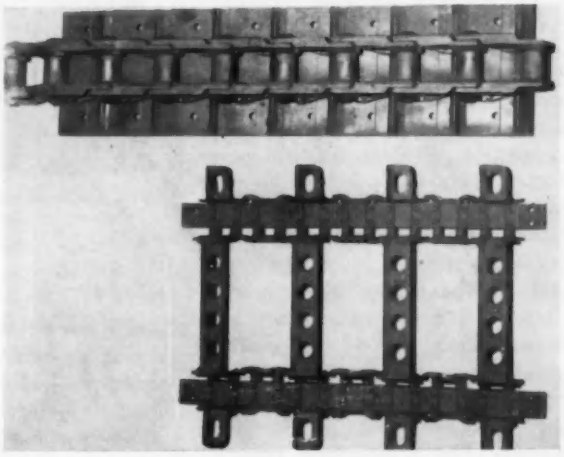


Fig. 4 — Vehicle track comparison spaced link track vs. commercial type track

Three Main Areas

The study of Land Locomotion Mechanics can be divided into three broad areas:

1. Study and measurement of those soil properties affecting land locomotion. (An aspect of this phase is the analysis of ground roughness as it affects vehicle performance),

2. Formulation of mathematical equations relating the vehicle to its environment,

3. Experimental verification of the ground-vehicle relationships evolved under (2), above, and modification of the theory were appropriate.

It is important to note that, under (1), above, the soil properties of interest in land locomotion mechanics are generally not those of interest to the civil engineer engaged in construction. The structural engineer is concerned with relatively small soil deformations occurring over long periods of time and over large areas, while the engineer involved in land locomotion is concerned with relatively large soil deformations occurring over short periods of time and over small areas. For this reason, a great deal of the information ob-

tained by civil engineers over the past hundred years or so is of little value in land locomotion.

Mathematical Models

When mathematical models of soil-vehicle systems have been developed and verified, it should be possible to conduct computer evaluations of various vehicle design concepts in order to determine the optimum design to meet any given set of operating conditions. Since the properties of soils may be expected to vary in a random manner, the final analyses will have to be made using statistical methods.

Engineers at the Land Locomotion Laboratory have conducted extensive laboratory studies of soil properties related to locomotion, and have devised a set of six parameters which characterize soils for these purposes. Working in soil bins under controlled conditions, the engineers can reproduce a wide variety of soil conditions occurring in nature, from loose sands to sticky clays. Here, the various types of loading are examined under known soil conditions, Figures 2 and 3. Universities and private research organizations, working under contract to the Laboratory, have conducted further theoretical studies of soils and their affect on locomotion. Studies are being conducted from the point of view of the modern theory of plasticity. Simultaneously, equipment is under development to conduct soil tests in the field. Since, as mentioned above, soil values vary randomly, extensive field tests will be required to determine the distributions of these variations, so that they may be used in statistical studies of soils and their relationship to vehicle performance.

Sporadic attempts have been made to relate soil conditions to vehicle performance since 1913, but concentrated effort has been made only during the past fifteen years. Researchers around the world are continuing and intensifying the study. To date, all results are only approximate, since they are based on limited experimental data, and a basic theory has not been established. Results are now being obtained, however. Engineers at Land Locomotion Laboratory can now make predictions, based on analytical computations, of the performance of a vehicle under given conditions. These companies consider such factors as track or wheel dimensions, wheel base, vibrational characteristics, and power available; the resulting predictions of drawbar pull per pound of vehicle weight, for example, have been accurate to within about 15 percent in the limited number of cases where it has been possible to compare predicted performance with actual performance. A chief cause of this relatively large variation is the variability and complexity of soil problems which can be handled only by means of simplified assumptions. Much effort is being expended in an attempt to improve the accuracy.

Fig. 7—Goer model test apparatus (U.S. Army photograph)

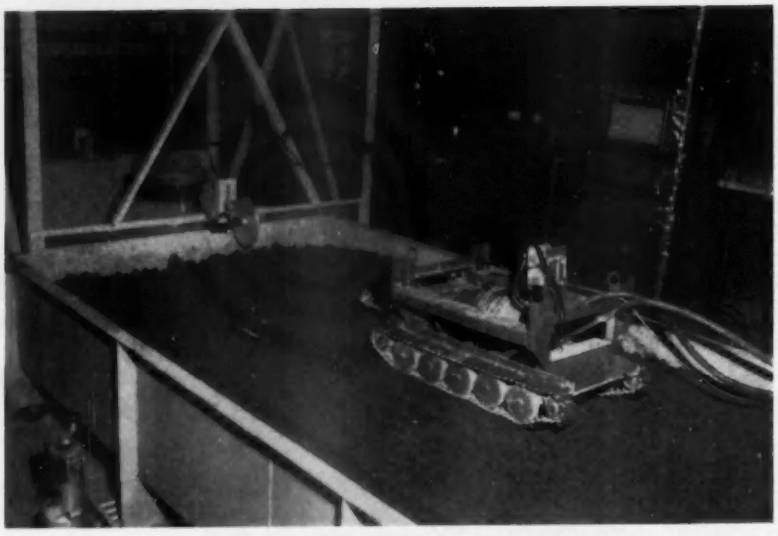


Fig. 8—Scale and model tests, light quarter front, linear displacement pot and gravity dynamometer load (U.S. Army photograph)

Vehicle Geometry

At the same time, other researchers at Land Locomotion Laboratory are investigating the effect of vehicle geometry on ride characteristics. A theoretical analysis is being conducted on an idealized vehicle moving over a random terrain profile; some preliminary re-

sults on the effect of varying wheelbase length on the vertical accelerations of the vehicle cargo compartment have already been obtained. Concurrently, an experimental device is under construction to perform scale-model tests of an idealized vehicle running along a known random track representing a section of ground in order to verify and amplify the theoretical analysis. The vehicle model can be modified to study the effects of varying geometry on vehicle response. Surveys of terrain profiles are being obtained to determine the range of terrain variations likely to be encountered. Again, extensive field studies will be required to secure the necessary data and to give a final check on the results. The end result should be an optimum vehicle configuration to yield the most stable gun platform for a tank, for example.

The eventual aim of the programs just described is to give the designer a method and a handbook in which he can look up the soil and terrain conditions in which his design will be expected to perform and calculate the size wheels, for example, required to give a particular tractive effort. He should also be able to determine the optimum wheelbase, length-width ratio, springing and damping required, etc.

The third phase of land locomotion research, experimental verification of the theory, is still in its infancy. Studies are under way to design the field experiments needed to verify theoretical predictions, on a large scale, and the equipment required to carry out these experiments. Until they are conducted, we cannot properly evaluate the present state of the art and the future avenues of approach.

New Concepts Emerging

What has been gained by this research? First, a general methodology has been developed. Next some promising concepts have emerged. It has long been known that soil will tend to "bridge" small gaps in an object moving through the ground or lying on it; this was used in the World War II landing mats, which employed steel planks with holes bored in them to decrease weight. Personnel of this Laboratory have developed a gun spade based on the same principle: by making a spade cleat in sections with gaps between sections, a much wider cleat, providing greater holding power, is obtained at no increase in weight.

Studies indicated that greater tractive effort might be obtained if track cleats (grousers) were spaced more widely than on conventional tracks. This led to the concept of the spaced-link track, which has been recommended for use in military vehicles, Figure 4. One method of obtaining a spaced-link track would be to remove every other grouser; in spite of the reduced grouser area, the tractive effort may even be increased. (In practice, the grousers were spaced after first calculating the spacing required.) In the few instances where this track has been given a field trial, it has indicated a definite tractive superiority to existing tracks when operating off-the-road.

Other studies indicate that the optimum form for cross-country vehicles is long and narrow; this is best accomplished by coupling several units together, as is done in railroad trains, Figure 5. Recommendations for a new family of vehicles, based on the train principle and the concept of articulation of vehicles (discussed below) have been incorporated in Land Locomotion Laboratory Report No. 59. A preliminary test vehicle, a three-unit articulated, spaced-link tracked vehicle, known as the "Cobra", Figure 6, has been built under contract for the laboratory. In preliminary field tests, it has successfully negotiated terrain impassable to other current vehicles, has given promise of the capability to climb slopes of at least 100% grade, and generally performed most encouragingly.

The concept of articulation referred to above is a new application of an old familiar idea. Wagons are steered by articulation. In a wheeled vehicle steered by articulation, both front wheels pivot about a single point, located away from the axle. In conventional automobile steering (Ackermann steering), the front wheels pivot about two separate pivot points located directly over the axle. Laboratory studies have indicated the superiority of articulated steering, by demonstrating improved ability to get out of ruts, and by demonstrating ability to cross otherwise impassable soils. In the case of the articulated tracked test vehicle mentioned above (the Cobra), steering is accomplished by means of hydraulic pistons between the units, which turn the units relative to one another. At least two units are required to provide steerability; coupling is made by means of universal joints in this case, so that all four tracks of a two unit vehicle are powered. A better-known example of an articulated vehicle, which also employs the large-diameter tires consistently recommended by Land Locomotion Laboratory, is the modified GOER, Figure 7, vehicle currently under test by the Ordnance Corps and the Armor Board.

The future of land locomotion mechanics will embody a continuation of the studies currently in progress, with increasing emphasis on statistical analysis and application of the methods of random processes. Field verification of theories must also be carried out; these theories are continually under revision in order to render them more exact. The goal is the formulation of a complete, coherent theory leading to a rational approach to the design of automotive equipment to operate under off-road conditions. The military application of such an approach will provide the U.S. Army with vehicles that can:

1. Move from point A to point B on earths' surface with greater probability of sucesss than the enemy's vehicles.

2. Move from A to B faster than similar enemy vehicles.

3. Move from A to B with significantly less logistical support than similar enemy vehicles. ■

Automatic Machining and Assembly of Connecting Rods at Evinrude

By KENNETH ROSE, Midwest Editor

SETTING up modern, almost completely automated production facilities for the connecting rods for its line of small gasoline engines, Evinrude Motors, a division of Outboard Marine Corp., has recently completed the line by adding an automatic assembly machine to the multi-operation machines. A line of engines ranging from 5½ to 75 hp, for marine outboard use and for various other applications such as power lawn mowers, is made at the Milwaukee plant.

A feature of the production line for the connecting rods is its versatility. Four Northwest Tool and Engineering Co. multi-operation machines take the connecting rods, forged of SAE 4615 steel, after both sides have been faced off and locating pads finished, and complete the machining ready for assembly. The machines are so tooled that one takes all 5½ and 10 hp engine rods, a second the 18 and part of the 40 hp rod output, the third the remainder of the 40 and part of the 75 hp production, and the fourth the remainder of the 75 hp size. In the case of the Gilman Engineering and Mfg. Co.'s Transferline assembly machine, five sets of fixtures are used, but these can be so adjusted as to assemble 15 different sizes of rods automatically.

Machining operations on the connecting rods are not identical on all models and sizes, but all follow the same general pattern of operations. Each machine is built around a center vertical column on which eight fixtures revolve, each fixture holding two rods. At the first station a rough rod is manually placed in the fixture and a finished rod removed. Each rod makes two revolutions, i.e., there are eight double stations; at the end of the first revolution the rod is manually reversed and inverted, and placed in the second position on the fixture. Machining heads are located outside the periphery of the circle of fixtures.

The following sequence of operations applies to rods for the 75 hp engine as shown in Fig. 1. While there are variations when other sizes are handles, the general pattern remains the same. The first station is for loading and unloading. The operator removes the

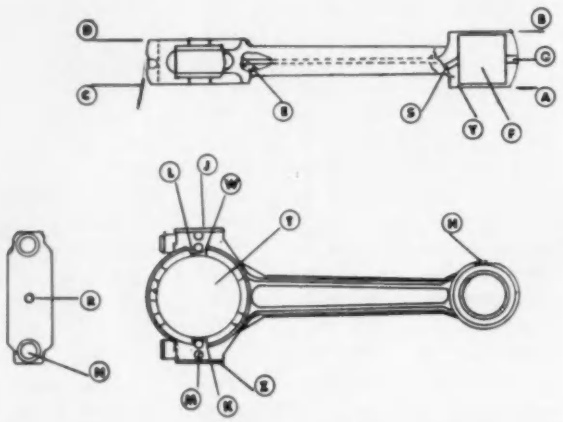
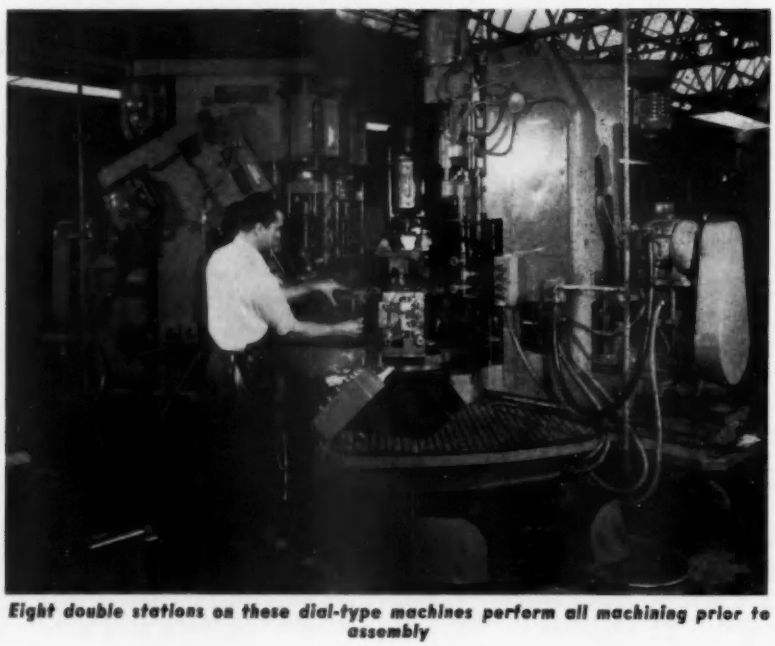


Fig. 1 Connecting rod for the 75-hp engine



Eight double stations on these dial-type machines perform all machining prior to assembly

finished piece, reverses the half-completed piece into the vacated position on the fixture, and loads a rough piece into the first position. At the second station an angle oil hole (S) is drilled into the piston pin end. The third station provides for the spotdrilling of the two bolt holes (N) on both sides, the drilling of the angle oil hole (E) into the crank pin end, and the spotfacing of the fracture holes (M) which form the line of fracture along which the cap is later broken from the rod. A hole is drilled in the piston pin end (G) at the fourth station, the bolt holes (N) are spotfaced, and the fracture holes (M) are drilled.

At the fifth station, the crank pin hole (T) is core drilled, and the piston pin hole (F) is drilled through and chamfered on one side. Station six is tooled for the drilling of the bolt hole (N) clearances to the required depth to clear the cap, and for redrilling the crank and wrist pin holes (T and F). At station seven the two bolt holes (N) are drilled through for the tap size, and the piston pin hole (F) is reamed. At station eight the two bolt holes (N) are tapped, and the crank pin hole (T) is reamed. This completes the two revolutions on the connecting rod machine.

Following the machining operation, the rods go through a heat treat cycle. The pieces are first deburred, and the fracture holes are broached. Before the beginning of the machining cycle the rough rods are copper plated; removal of the copper plate from the machined surfaces permits these surfaces to be carburized during the heat treat cycle. The rods are fed into a salt bath carburizing furnace at about 1700 F, held at temperature for 4½ hr, and then quenched in oil.

The automatic assembly machine is manually fed and unloaded mechanically, but all the rest of the work is automatic. While there are five sets of pallet-like fixtures, 18 in each set, that carry the rods through the machine, components of certain of the fixtures can be changed to accommodate changes in the design of the connecting rods. This gives the machine great flexibility. If the length from crank to piston pin is changed, the locating spindles can be changed. If the center line of screw holes is changed, or if bores are changed, adjustments must be made on the machine itself.

While there are eight stations on the assembly machine, only five are actually operating with the present connecting rods. The other stations are left open to permit additional operations in case of a change of part design or of procedure. Each connecting rod is mounted on a fixture, the fixtures moving in unbroken sequence through the machine, first along the front, then returning under the operating stations. Each rod is positioned by locating spindles in the

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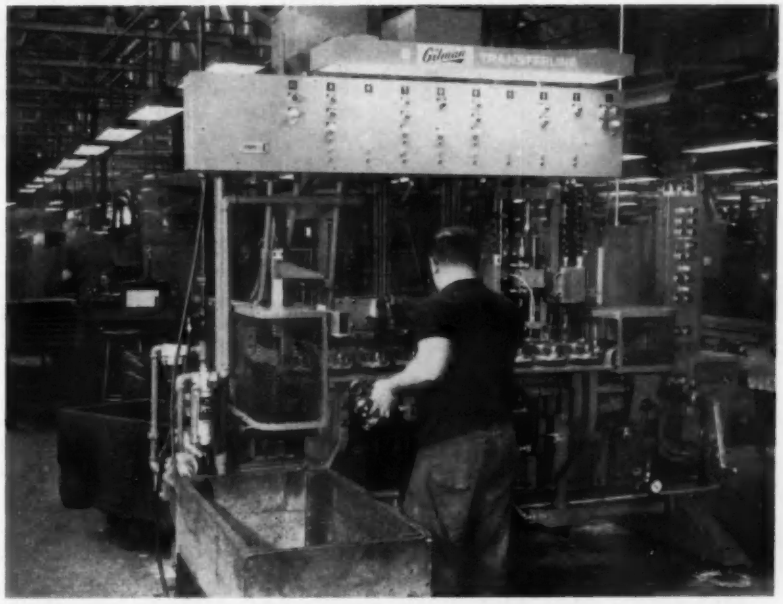
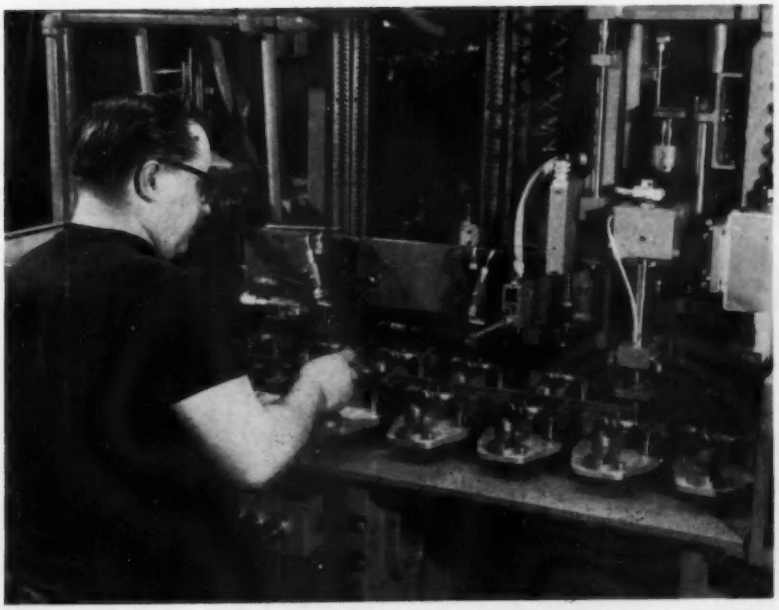


Caps are split from the rods and bolted automatically on this machine



Connecting rods are carried through the machine on fixtures for the assembly sequence

Arc Welding Rear Axle Housings at Buick

By W. F. Williams and S. M. Spice

Buick Motor Division, General Motors Corp., Flint, Mich.

IT is of interest that the Buick rear axle department was reorganized and provided with new equipment for the 1956 models as described in some detail in AUTOMOTIVE INDUSTRIES, February 1, 1956. At that time the mechanized welding operations on the rear axle housing were performed on machines fitted with Lincoln Electric and Linde submerged arc welding heads, the latest technique available at the time. As the authors indicate in this paper for 1961 production most of the operations originally done with the submerged arc are performed with the newly developed technique of "Innershield" arc welding being exploited by Lincoln Electric. Other kinds of welding operations also are employed, including CO^2 and metallic arc inert gas. Some of the operations still continue the use of submerged arc welding as indicated.

—EDITOR

THE modern-day rear axle housing is a perfect example of the cooperation that exists between different manufacturing groups. Increasingly more complex assemblies are being welded and held to ever closer dimensional tolerances through advances made in die design, welding processes, machine fixture design, and metallurgical control of materials. Welding processes of 15 years ago are being used to weld today's assemblies to tolerances unheard of then. It has been through mutual understanding of problems and working together toward solutions that industry has advanced to the point where yesterday's frustrations are now today's common occurrences.

The basic Buick axle housing has not changed too much during the last 15 years. Material thickness has increased with the greater loads being applied. The contour has changed somewhat to fit new designs and the brackets have become more and more complex. The methods of welding the housing have varied considerably, however, as the production problems of past years were solved by advances within the industry.

Buick's present-day axle housing line starts out with the housing halves being blanked from 0.180-in. thick coil stock. The housing is then formed through a series of progressive dies in two presses, the largest being 2000 tons. All four seam weld joints are coined in the last die operation and the housing halves are delivered to the washer. The top and bottom housing halves are identical.

After being washed, the halves go to the seam welders on a float-type conveyor. The housings are loaded in the welder, clamped, and all four seam welds made by submerged arc welding. The housing

Fig. 1—Automatic welding of end flanges on the rear axle housing is done with inner-shield welding heads. The greater speed of this new technique makes it possible to weld in two revolutions in the same time required originally for just one revolution plus reversal time.

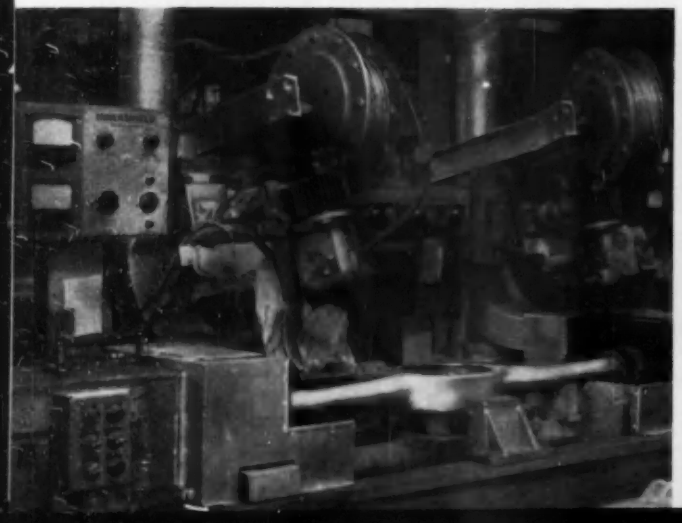


Fig. 2—The elliptical weld for integrating the cover with the housing is 37½-in. long. It is done with the Lincoln Innershield automatic welding head. The new technique makes it possible to handle the entire requirements with one machine instead of two machines required heretofore.

halves are located from the ends, so that the end of the housing is flush. This controls accurately the length of the subassembly. The lower dies of the welder are contoured to the housing and are made of aluminum bronze. They form the necessary flux dams that hold the weld metal up during the welding process.

With the added strength of a welded cover, only 60 per cent minimum penetration is required of the seam welds. The quality of the weld is very good, considering the fact that each housing has over 85 in. of seam welds and the welds are pressure-tested at 8 psi air pressure under water. A 10 per cent repair rate means that a pinhole is encountered only once in every 70 linear feet of weld, a remarkable record for any welding process. The welding schedule has to allow for minor variations in part fit-up and seam misalignment. Welding processes that develop narrow, deep-penetrating welds could not be used successfully on this operation. We use ⅛-in. diameter wire at 460 amp, 26 v, at a speed of 65 ipm.

The housings next go to the flange welders. Here, the flanges are pressed into the housing ends and both flanges welded simultaneously. In the process of cold-forming the flanges, a flat is sized perpendicular to the center line of the flange in the contour of the extruded section of the flange. The relationship between this flat and the outboard face of the flange is held to 0.010 in. To assemble, the flanges are positioned radially in a rotating fixture. The banjo is located radially in a disappearing fixture and then the flanges are pressed into the housing until the end of the housing seats against the sized flat on the flanges. This method keeps the housing weld within the length tolerance.

The welds are made using the new Lincoln Electric "Innershield" flux cored wire automatic arc-welding process (Fig. 1). The flanges were designed with this process in mind. The contour breaks away from the sized flat and housing end, so that sufficient penetration is obtained and control is still held over the molten weld metal.

These machines formerly used submerged arc-welding heads, but were easily converted to the newer process. As seen in Fig. 1, the wire contacts the work at a point off top center about 1⅛ in. at an angle of approximately 25 deg from the horizontal and about 65 deg from the housing center line. *(Cont'd)*

Fig. 5—Here is a view of a welding station devoted to making the four welds on the track bar bracket.

Fig. 3—Innershield welding of all four circumferential welds for the two brackets is done in a single cycle in this machine.

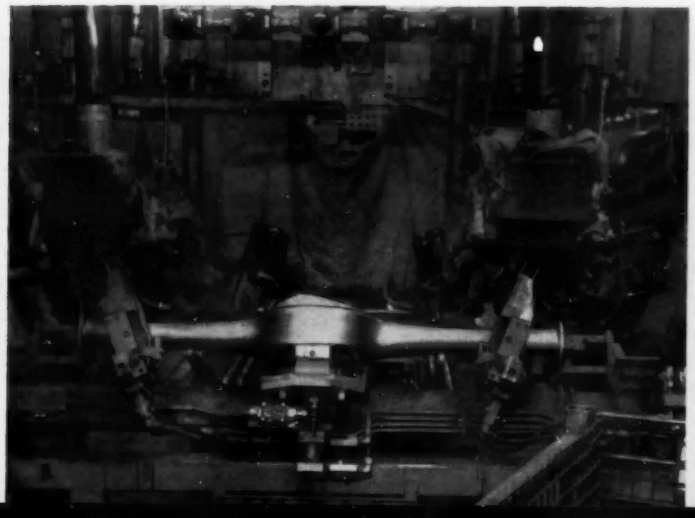
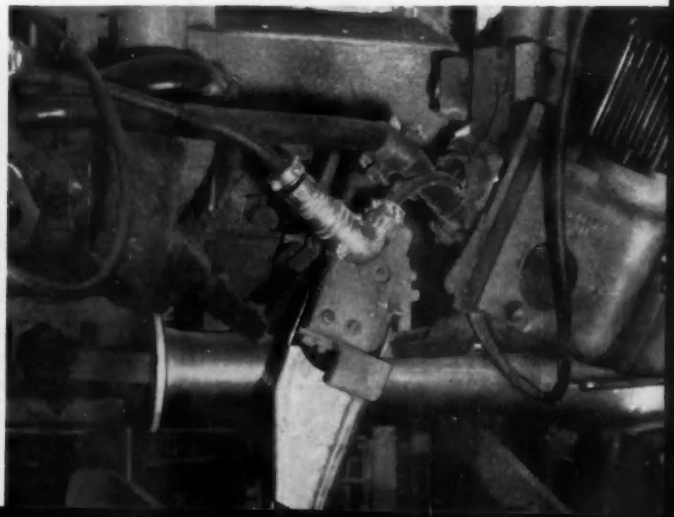


Fig. 4—This view shows one of the brackets in position to start the welding operation.



Each flange has a flat on its circumference that must be held to a definite relationship to the banjo face. As these flats are located radially by the rotating members, this alignment is important. If rotation can be made in only one direction, without reversing to compensate for overlap, this problem can be minimized. The machines now cut off the weld at the end of the overlap, continue on in the same direction until the starting point is reached, at which time the dynamic brake stops rotation. Thus, two revolutions are made in approximately the same time as it took for one revolution plus reversal with the old process.

After water-testing and straightening, the housing is ready to have the various brackets and the cover welded to it. The cover is the first thing welded to the housing. These are also submerged arc welders converted to the "Innershield" process. The cover is formed from 0.150-in. stock and must be flat.

As the cover is elliptical in shape, the angular relationship between the cover and the wire is constantly changing as the housing rotates. The welding schedule has to be a compromise to suit these changing conditions. Fixturing has to be accurate and part fit-up very good, or excessive porosity will result. This joint also has to be pressure tight. The weld is 37½ in. long, including overlap, and is made at 750 amp, 25 v, at speed of 75 ipm, using 5/32-in. diameter wire. As shown in Fig. 2, a 50-deg drag angle is used with rotation in a clock-wise direction. The welding head moves in one plane to follow the contour of the rim of the cover.

The housing next goes to a semi-automated welding line. The operations are divided into three groups. Each group of machines or operations has an operator who loads the first operation, then all subsequent operations in that group are carried out automatically. The parts are transferred by shuttle-type conveyors from one station to another and ejected onto moving conveyors which carry them to the next operation group.

The first operation is to make the four circumferential welds fastening the two lower control arm and shock absorber brackets to the housing assembly. As shown in Fig. 3, all four welds are made at one time, again using the "Innershield" process. Fig. 4 shows the bracket in "weld start" position.

To obtain the desired head angles, it is necessary to load the bracket and housing in a fixture that rotates on the housing center line. The fixture then rotates up to weld position, the heads drop into location, and the fixture rotates back during the weld cycle to the start position, where the axle assembly is ejected onto a conveyor.

A moving conveyor now takes the housings to the next group of operations, comprised of two machines and five "Innershield" welding heads. The housing and upper control arm bracket are loaded in the first station and clamped. The fixture swings up toward the operator, the welding heads drop into position and one circumferential weld is made on the bracket. The center line of rotation of the fixture is then shifted, the fixture raises, and the second circumferential weld is made. This is necessary, because the bracket is located high on the banjo contour.

In the following station, three horizontal welds are made approximately in the down-hand position. A weld is made on each of the lower control arm brackets and the upper control arm bracket.

The next group of operations consists of a welding station with two heads, two idle stations, and another welding station, also with two heads. These operations are devoted entirely to making the four welds on the track bar bracket (Fig. 5).

The housing and bracket are loaded in the first station. The fixture is tilted 10 deg so that the welds may be made downhill. After welding the two horizontal joints, the fixture dips down and the assembly is transferred onto the shuttle conveyor. After going through two idle stations, the assembly is ready to have the two circumferential welds made. The bracket does not sit on the housing squarely, but is tilted to one side. To complicate matters even more, the angle is not the same for both sides of the bracket; one side tilts more than the other. Closer examination of the weld joint reveals that the welds cannot be made at the same time, but must be independently cammed.

The front welding head drops into position and the fixture rotates, making the weld. The head follows the weld line by means of a beam, cam and follower arrangement. After the first weld is made, the fixture continues to rotate in the same direction for some distance before stopping. The back welding head then drops in position and the direction of rotation of the fixture is reversed, making the second weld. It also uses a similar camming arrangement to follow its weld line. The welded assembly is ejected onto a conveyor, where it goes on to subsequent manufacturing operations.

Three of the four brackets on the axle housing are themselves welded subassemblies, using submerged arc welding. The fixture and the part itself act as a flux shelf.

The lower control arm bracket is welded in a machine, each head of which has its own independent travel means and the welds are made at a rate of 75 ipm. The "Innershield" process is used for this application.

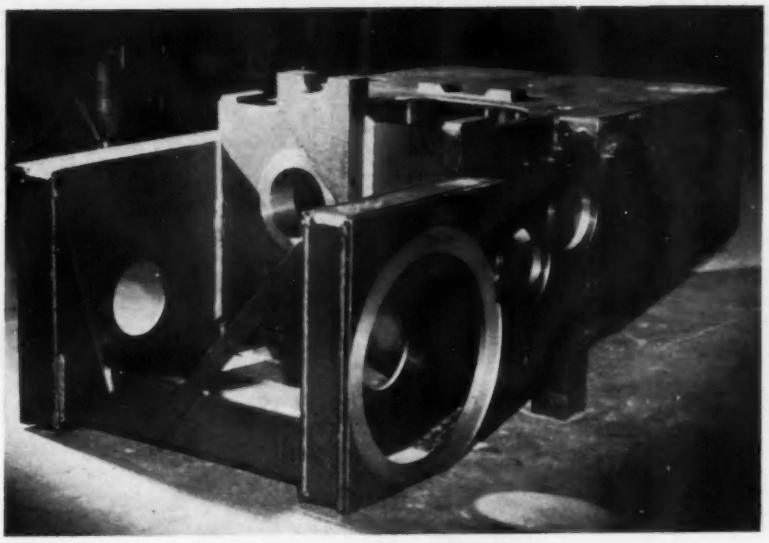
As the dimensional accuracy of this part is important, the part is restruck in a die after welding and sized. The weld lines are trimmed at the same time, thus resulting in a better part fit-up, as well as dimensional location when welded to the housing.

There are 29 automatic arc welds on the completed axle housing assembly for a total of 19 ft 4 in. of welding. Submerged arc welding accounts for 100 in. and "Innershield" welding for 132 in. One hundred forty-five inches have to be leakproof welds, and are water-tested. ■

The foregoing article is an abstract of a paper presented by the authors at the 1961 SAE National Automobile Week held in Detroit last March.

Special Purpose Machines Bore Tractor Gear Case

By Kenneth Rose
MID-WEST EDITOR



The tractor gear case, after boring

FOR its largest motor scraper models, including the recently announced TS360 30 cu yd scraper, Allis-Chalmers Mfg. Co.'s Construction Machinery Division Works at Cedar Rapids, Iowa, uses a power train housed in a welded steel gear case.

The gear case houses the gearing from propeller shaft to final drive, and shafts are located on three principal axes. It is about 6 ft by 6 ft by 3½ ft. At the rear of the case is the axis of the final drive and an idler gear, running laterally through the case. Ahead of this is the axis of another line of gears, parallel to the axis of the final drive gear. At right angles to this axis is the axis of the propeller shaft, entering the gear case from the front.

Boring the gear case along these three axes so that the relationship between them could be held exactly presented problems. Five bores were required along the line axis —the rear lateral axis. The final drive axis was not continuous through the case, so that two stub bores must be made, one from either side of the case. Finally, the bore for the propeller shaft bearing, termed the pinion bore by the company's engineers, must be exactly at right angles to the axis of the line bore. In addition, there were counterfaces to be cut on most of the bored surfaces.

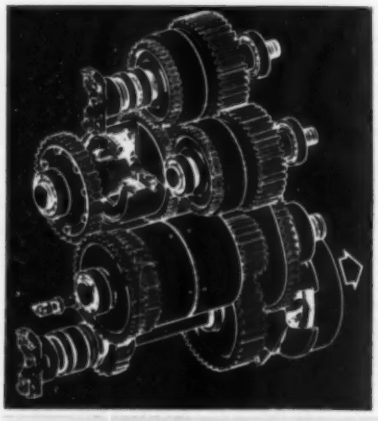
To meet all these conditions, two special machines have been constructed or adapted for the boring operations, along with special positioning fixtures. In the first, with the gear case in one setup, the pinion bore and the line bore are made and counterfaced, while both stub bores are made in the second machine. The case is positioned in the proper slanting position by welding four rest pads on the bottom. Three locating buttons are provided for squaring the case in the fixture. Two of the rest pads are removed after machining.

The first machine has a table with two horizontal boring heads mounted on ways at right angles to each other, so that one operates longitudinally, the other laterally on the workpiece. By making the pinion bore and the line bore in a single setup, the accuracy can be built into the machine and setup inaccuracies eliminated. The pinion bore is cut to 7.252-7.254 in. diameter by the longitudinal boring head. A boring bar about 6 ft. long in which five cutters are mounted is set up in the lateral boring head, extending to a guide bushing in a steadying column at the far side of the machine table. The five diameters in the line bore are cut simultaneously, the first and second to 6.751-6.753 in., the third to 6.741-6.743 in., and the fourth and fifth to 6.751-6.753 in. The bar is then backed out, the guide blocks changed, and another bar is inserted to counterface four of the holes, also simultaneously.

The second special machine is a Giddings & Lewis horizontal boring mill modified by addition of a supplementary boring head on the side of the table opposite to the standard machine head. The gear case is held in a fixture on the table, and stub bores are made on opposite sides, with bars from each of the boring heads. The idler bore is made 6.751-6.753 in. in diameter on the outside, and the inside bore is cut to 5.511-5.513 in. diameter. From the G & L head another bar cuts the final drive bore, with the bar passing through the gear case and riding in a guide bushing on the opposite side. The bore is cut to 18.751-18.756 in. diameter, and the counterface is 21½ in. in diameter. Special facing tooling is mounted in the guide bushing at the far side of the bar after the bore has been cut, and the bore is then backfaced.

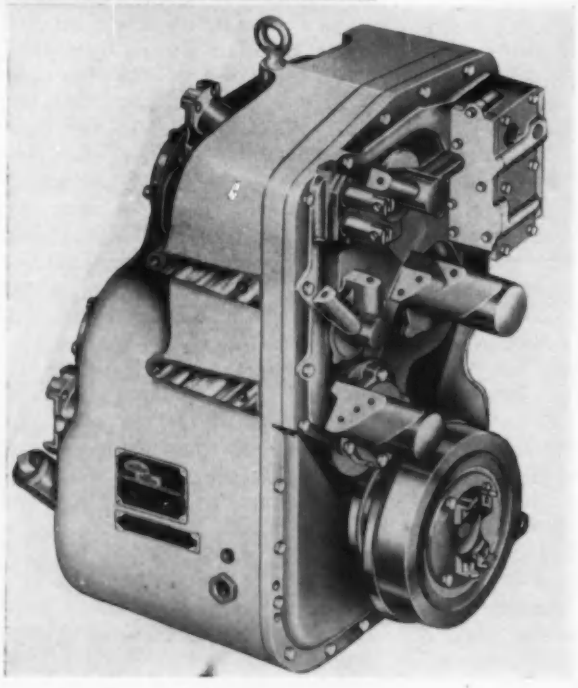
The dimensions here given are those for the 260 model motor scraper. The gear case for the new 360 model is similar, but with different bore diameters. Both gear cases are bored on the same special machines. ■

NEW
POWER-SHIFT TRANSMISSION
for Material Handling or Construction
VEHICLES



Arrangement of gears and clutches in the Model TD-44-400 Series power shift transmission

The new Twin Disc power-shifted, forward- and reverse transmission

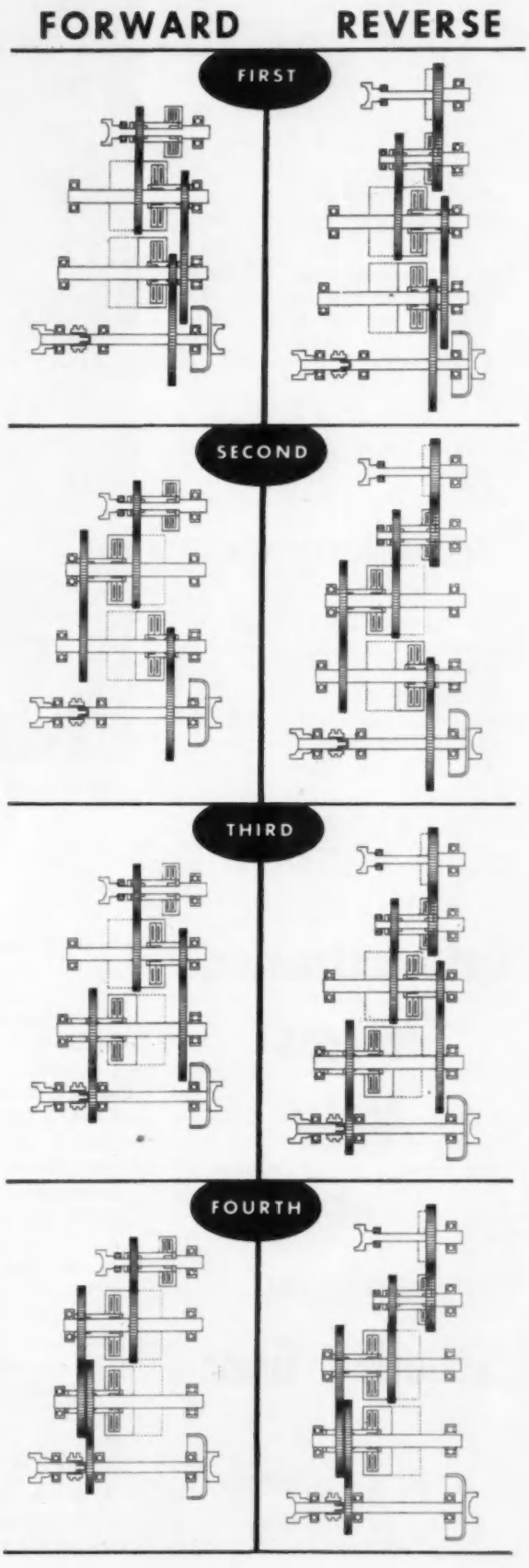


A NEW power-shift transmission especially designed for use in front end loaders and other construction or materials-handling vehicles has been announced by Twin Disc Clutch Co., Racine, Wis. It provides four speeds forward and four in reverse, with full power-shifting in all speeds. The drop box transmission would ordinarily be furnished with a Twin Disc single-stage torque converter as a converter-transmission package. Recommended maximum net input to the converter is 75 hp at 1800 rpm to 108 hp at 3000 rpm.

The new transmission is offered in two models, each with a spread of 6.91 to 1. For the TD-44-403 the ratios are 4.89, 3.19, 1.08, 0.705, while the TD-44-404 model provides 5.98, 3.92, 1.32, 0.866. Ratios are the same forward or in reverse.

The transmission is a simple countershaft design. Constant-mesh spur gear trains are actuated by multiple-disk, hydraulically-actuated clutches. Forward and reverse directions are controlled by two large single clutches, oil-cooled for maximum heat dissipation, which function as the energizing clutches for all engagements. They are carried on the top shaft and the idler shaft. Speed changes are accomplished by two duplex clutches, shown on the countershafts in the schematics. In the schematics the disengaged clutches in these duplexes are shown by dotted lines only.

As the duplex range clutches are engaged prior to the energizing direction clutch, the range clutches do not have a neutral position. Each time a range clutch is shifted, the direction clutch is automatically disengaged momentarily, thus absorbing the energy of the shift.



Power flow through the Model TD-44-400 series transmission

Operation of the transmission from the driver's seat would be through a fingertip control lever connected through linkage with a spool valve controlling the hydraulic actuation of the range clutches. Another linkage positions another spool valve that controls the directional clutches. It is possible to produce a linkage that will tie both controls to a single lever so that it would control both forward-reverse motion and speed.

A sumpless 1300-series torque converter that would be a part of this power package has two power take-off points. One would ordinarily be used in conjunction with the vehicle hydraulic steering system, while the other incorporates an SAE "C" pump mounting which can be used for a hydraulic power pump. The oil supply pump for the oil-actuated transmission clutches also is mounted on the converter. Pressure regulators, selector valves, and the brake-regulated clutch release valves are mounted on the transmission. A cascade system of oil pressure regulation is used for clutch engagement, for which a controlled pressure rise valve increases the pressure steadily and rapidly for smooth engagement.

Clutch Release Valve

The brake-regulated clutch release valve is ported for direct connection to the vehicle brake fluid system. When the brake pedal is depressed, all clutches in the transmission are released, and power transmission is immediately cut off.

Both ends of the output shaft are equipped with yoke-type universal joint connecting members as standard equipment. A parking brake and a disconnect jaw clutch are standard equipment on the output shaft. The disconnect jaw clutch may be engaged for four-wheel drive operation or disengaged for single axle drive functions.

The transmission has been designed for easy servicing. Removing the main housing cover permits complete access to all clutches and range gears. ■

By Joseph Geschelin
DETROIT EDITOR

View of 1000-ton Verson press used at Saginaw for the cold extrusion process.

Cold Extrusion Process *NEW* at Saginaw Steering Gear

ONE of the leading practitioners in the automotive industries of the art of cold extrusion, Saginaw Steering Gear Division of General Motors Corp., is grooming its facilities to serve other divisions of General Motors; and may offer its services as a cold extrusion specialist to suppliers outside the family as well.

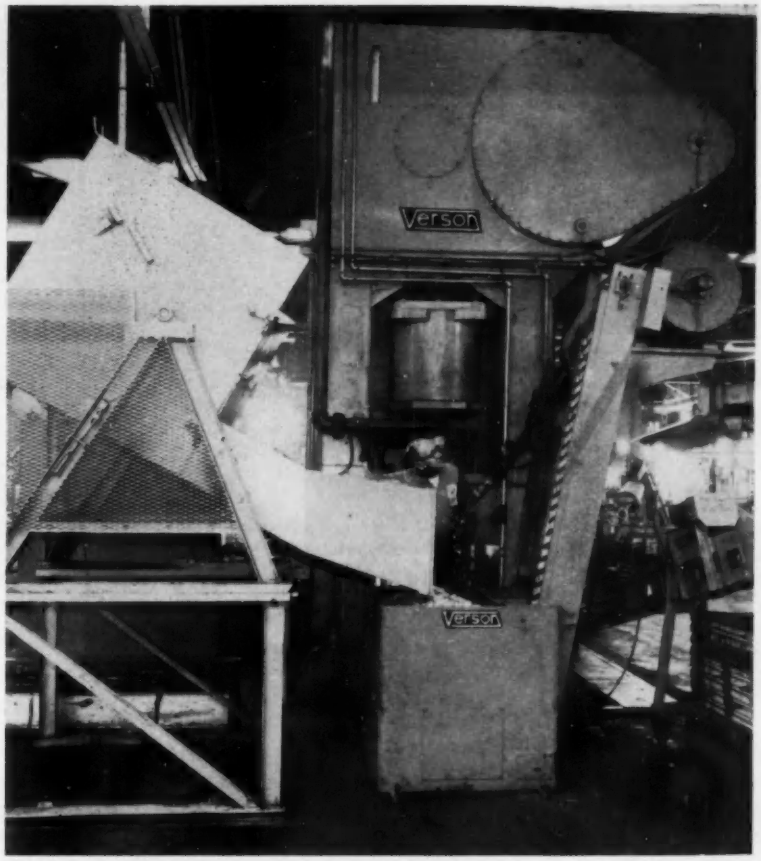
Latest development at SSG is found in the volume production of several sizes of ball joint housings by cold extrusion in a 1000-ton Verson Transmat (transfer feed) press. The present program includes manufacture of four different sizes of sockets, three of these being produced now.

Prepared Slugs

As is customary in current practice the process employs previously prepared slugs. These are fed automatically from a hopper through the side of the press to the transfer feed mechanism. The die designed for this purpose is of four-station type with individual dies at each station. The automatic cycle of events in the press is as follows:

1. **Backward extrude**
2. **Probe for broken extrusion punch**
3. **Pierce bottom**
4. **Coin flange and form bottom**

Transfer bars in this press are driven by a linkage from the crankshaft in a modification of the standard Verson Transmat feed mechanism. The press operates at 26 strokes per minute, producing a finished socket for each stroke. It is equipped with a hydro-mechanical lift-out to provide a fully adjustable lift-out stroke. Transfer fingers are equipped with an air sensing device to indicate the pres-



End view of Verson Transmat press showing the method of feeding slugs to the transfer mechanism. Slugs are stored in the hopper at the left, dumped into the bin in the foreground.

ence of work pieces in the die.

The basic feature of the technique, of course, is that it is substantially a chipless method that conserves material. The only machining required is an undercut for rolling threads on the OD, and a chamfer on the hole for stud clearance. The final operation before assembly is heat treating.

The prepared slug is a key to the success of the cold extrusion operation. Saginaw uses two different bar sizes—1¼-in. and 1⅜-in. in diameter—both being of SAE 1012 modified H. R. steel of cold extrusion quality.

Operations

The slug is sheared to size as the first operation. This is closely controlled because the weight of the slug must be accurately held to plus or minus four grams. The sheared slug then is shot blasted.

The next operation is coining and this too is subject to close control since the shape of the slug is depended upon to maintain a square top surface for the first extrusion operation. Moreover, the concentricity, both of the OD and ID, of the extrusion must be held to a tolerance of 0.008-in. to prevent punch breakage in the fourth station in the press die.

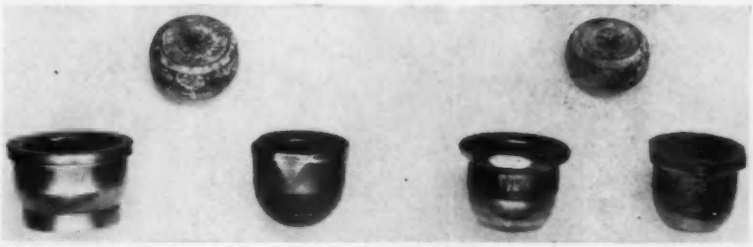
The slug now is annealed under controlled conditions to make sure that hardness does not exceed Rb 70. Following this the slug is shot blasted once more.

Final operation is phosphate coating and Parco Lubricating. This operation, too, is subject to close control since it is essential to produce a coating of maximum weight. This has been found necessary to prevent pick-up of the extrusion punch.

Management of the press dies is an important factor in producing acceptable parts. Punches and dies must be kept highly polished and free from tool marks. Any pick-up or loading must be removed immediately by polishing.

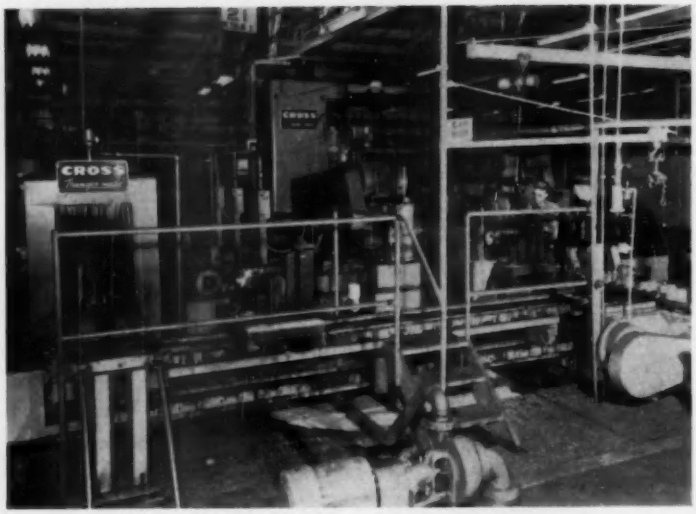
Soap build-up in the dies is a continuing problem in cold extrusion. This variable is held under control by spraying an oil fog mist into the die cavity.

The company is producing numerous other parts by cold extrusion, the ball socket described above being the latest application. Experience gained over the years and the know-how that has been acquired in the process should be of value in a further exploitation of the technique in serving other manufacturers. ■



Reading left to right, this illustration shows two ball joint housings for Cadillac; two for Buick. The slug for each pair is seen above the parts.

Machining Axle Housings and Cylinder Heads at Deere's Waterloo Plant



A transfer machine, first in the Deere organization, begins the machining of rear axle housings

This is Part IV of a four-part article by Kenneth Rose devoted to the Waterloo, Iowa, plant of Deere & Co.

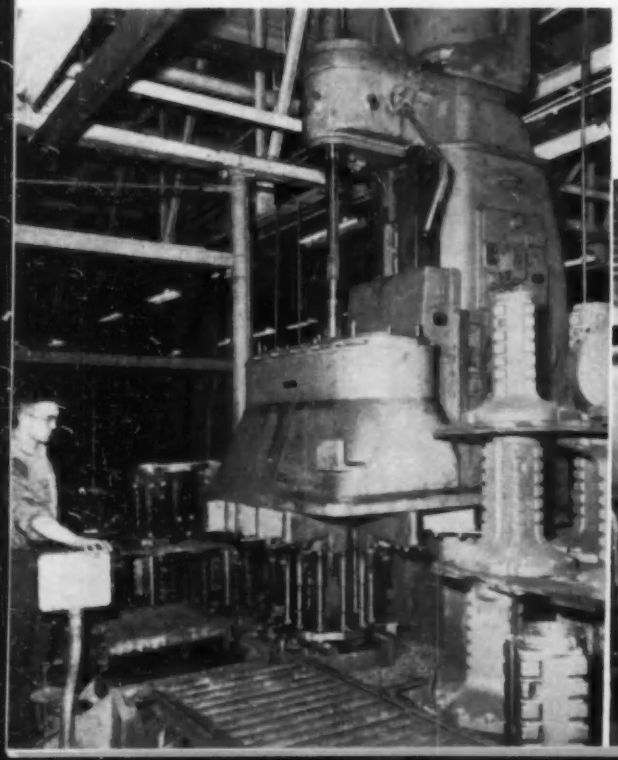
By Kenneth Rose
MID-WEST EDITOR

THE first transfer machine to go into service in the John Deere organization, and one of the first in farm equipment manufacturing, is a part of the production line for rear axle quills at the Waterloo Tractor Works. It is an important part in the changeover from Deere's former style tractor to the models introduced late in 1960, and the corresponding changeover in production equipment, largely from general purpose machine tools to special purpose tooling.

Rear axle housings or quills are made for both the 3010 and 4010 model tractors on the same production line. They are gray iron castings, cast in the foundry that is a part of the Waterloo plant.

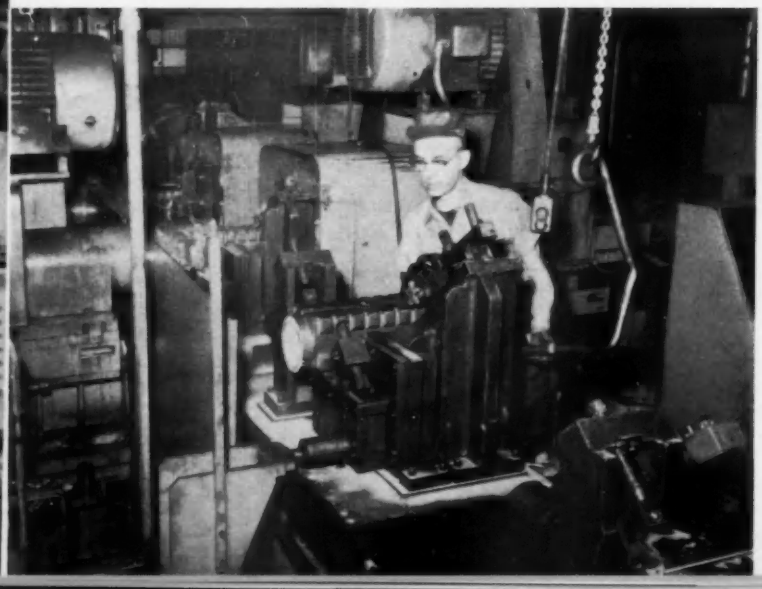
Cleaned castings come to the machining line, in which the first machine is the Cross transfer machine. One station serves for loading and unloading the machine. While the machine as now in use has three

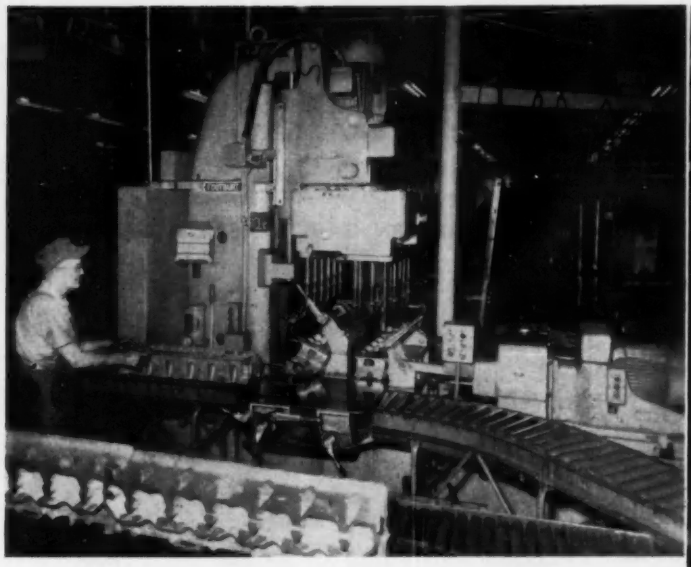
Cap screw holes in rear axle housings are faced on a multiple-spindle drilling machine



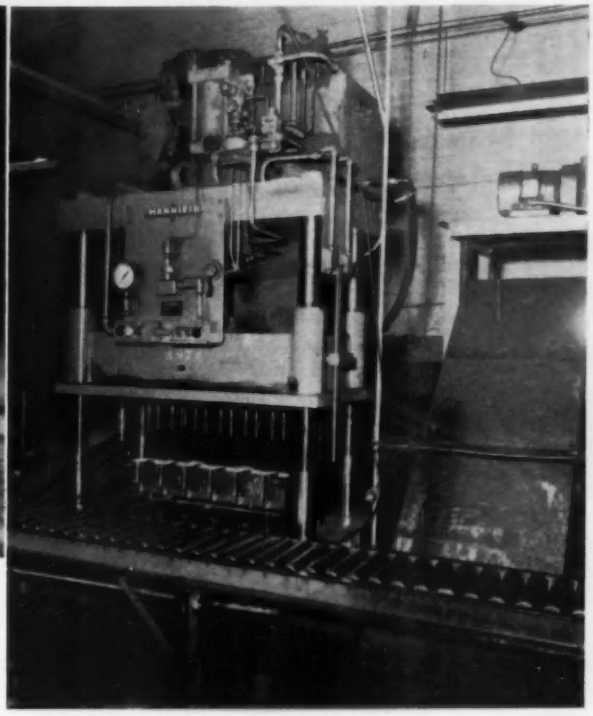
PART IV

Loading a pallet-type fixture at the first station of the Cross transfer machine





By working on two cylinder heads simultaneously, one in each position, this two-way, two-station tapping machine does double duty



Valve guides are pressed in on a hydraulic press ▶

working stations in addition to an automatic washer, there are provisions for adding stations later if this should be required. The castings are carried on pallet type fixtures through the sequence of operations, and the machine has a capacity of six pallets.

After the casting is loaded into the fixture, the pallet moves to the first work station, where both ends are rough bored and faced. In the second work station the ends are finish bored, chamfered and faced complete. The third station drills 12 holes 21/32 in. in the flange for attaching to the transmission case; two $\frac{5}{8}$-in. dowel holes are drilled, chamfered, and reamed, and two vertical holes, one $\frac{1}{4}$-in. and one 5/16-in., are drilled and tapped. Workpiece and pallet then move through a washer, and finally return to the loading-unloading station.

The next machine on the production line is a Natco drilling machine, in which the 12 drilled holes are spot faced 1-5/16-in. in diameter. The final drive gear, an internal ring gear, is then pressed into the housing, using a Hannifin press. The gear is first chilled to about –15 to –25 F in a Cincinnati chiller to shrink it so that, with the 0.010-in. oversize allowance for the fit, it presses in with little pressure. The fit is thus a combination press and shrink fit. Machining is then completed on a special inverted drill which cuts radii and drills and reams three retaining pin holes in the shrink fit circumference. These three holes are burred and blown out. The pins are placed at assembly.

Another new production line is that for machining the cylinder heads for the new engines. One line is used to machine gasoline, LP gas, and Diesel heads for both four- and six-cylinder engines. The procedure for the four-cylinder Diesel head is described here. These are gr[illegible]n castings from the Deere Waterloo foundry.

Cleaned castings start [illegible]he line on a Cincinnati milling machine, which m[illegible]he manifold face. The top face is then milled in a [illegible]dstrand milling ma-

(*Turn to page 71, [illegible]ase*)

A Footburt boring machine bores valve guides and cuts valve seats

INDUSTRY STATISTICS

By Marcus Ainsworth, STATISTICAL EDITOR

WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

Make	Weeks Ending May 13	Weeks Ending May 6	Year to Date 1961	Year to Date 1960
PASSENGER CAR PRODUCTION				
Total—American Motors	9,159	8,729	120,141	202,696
Chrysler	2,114	2,092	33,349	36,689
De Soto				14,190
Dodge	3,837	4,002	45,608	166,502
Imperial	46	7	2,778	7,126
Lancer	984	1,194	15,385	
Plymouth	4,414	4,856	61,309	117,573
Valiant	3,294	3,186	41,158	107,069
Total—Chrysler Corp.	14,689	15,337	199,507	451,139
Comet	4,736	4,320	57,284	45,039
Falcon	13,460	12,363	167,500	194,952
Ford	22,799	21,070	294,077	447,561
Lincoln	481	468	12,059	9,391
Mercury	2,677	2,519	35,762	73,502
Total—Ford Motor Co.	44,153	40,740	566,682	770,485
Buick	3,299	3,352	63,745	122,411
Buick Special	2,199	1,878	26,872	
Cadillac	2,714	3,384	62,869	67,963
Chevrolet	31,039	29,517	459,273	730,348
Corvair	8,010	7,718	131,257	122,653
Oldsmobile	4,071	3,784	85,242	164,227
Oldsmobile F-85	1,246	1,078	24,054	
Pontiac	4,400	4,413	82,930	190,642
Tempest	2,905	3,039	44,497	
Total—General Motors Corp.	59,883	58,163	980,739	1,398,244
Total—Studebaker-Packard Corp.	1,535	1,492	21,672	50,591
Checker Motors	128	155	2,224	2,969
Total—Passenger Cars	129,547	124,616	1,891,045	2,876,104
TRUCK AND BUS PRODUCTION				
Chevrolet	7,752	7,621	122,825	189,277
G. M. C.	1,356	1,351	25,117	44,929
Diamond T	21	41	629	1,151
Divco		60	872	1,732
Dodge and Fargo	1,443	1,448	23,846	31,065
Ford	7,669	7,226	126,182	149,839
F. W. D.	20	18	333	441
International	3,070	3,210	53,595	53,144
Mack	203	196	3,642	5,601
Studebaker	48	233	2,817	6,053
White	315	355	6,361	7,454
Willys	2,138	1,145	39,814	54,454
Other Trucks	80	80	1,440	1,953
Total—Trucks	24,117	22,968	407,473	547,113
Buses	83	113	1,401	1,534
Total—Motor Vehicles	153,747	147,715	2,299,919	3,424,751

NEW FOREIGN CAR REGISTRATIONS*

MARCH

1961		1960	
Volkswagen	15,881	Volkswagen	14,740
Renault	3,687	Renault	7,951
Fiat	1,355	English Ford	2,925
Mercedes Benz	1,090	Opel	2,861
English Ford	1,089	Fiat	2,407
Opel	994	Simca	1,627
Triumph	957	Triumph	1,482
Volvo	890	Austin Healey	1,454
Austin Healey	840	Peugeot	1,323
M. G.	731	M. G.	1,309
All Others	6,553	All Others	12,231
Total	34,067	Total	50,310

THREE MONTHS

1961		1960	
Volkswagen	42,538	Volkswagen	38,224
Renault	8,599	Renault	20,913
Opel	2,959	English Ford	8,546
Fiat	2,762	Opel	7,756
Mercedes Benz	2,586	Fiat	6,477
Volvo	2,278	Simca	4,462
Triumph	2,199	Vauxhall	3,854
English Ford	2,143	Triumph	3,650
Austin Healey	1,876	Hillman	3,505
Simca	1,806	Volvo	3,472
All Others	16,677	All Others	32,639
Total	86,433	Total	133,498

1961 TRACTOR SHIPMENTS

WHEEL TYPE

Hp. Ratings	March	Three Months
9-34 belt hp.	2,381	6,316
35-39 belt hp.	3,675	8,523
40-44 belt hp.	1,958	5,178
45-49 belt hp.	2,496	6,468
50-59 belt hp.	4,269	11,847
60 belt hp. and over	8,602	20,776
Total—Wheel Type	23,381[1]	59,128[2]

TRACKLAYING TYPE

20-59 net engine hp.	717	1,922
60-129 net engine hp.	523	786
130 net engine hp. and over	655	845
Total—Track Type	1,895[3]	3,553[4]

1—Valued at $60,336,000
2—Valued at $151,614,000
3—Valued at $21,998,000
4—Valued at $57,871,000

1961 NEW REGISTRATIONS*

Arranged in Descending Order According to the 1961 Three Months' Totals

NEW CARS

Make	March 1961	February 1961	March 1960	Three Months 1961	Three Months 1960
Chevrolet	131,864	100,892	156,420	341,043	365,821
Ford	106,438	86,863	125,367	285,925	340,920
Pontiac	30,249	23,824	36,317	81,556	90,599
Rambler	29,896	21,684	36,336	76,924	92,100
Oldsmobile	25,941	20,437	31,532	70,739	82,034
Plymouth	25,656	19,874	42,906	67,729	103,619
Buick	22,440	16,930	22,852	59,955	62,275
Dodge	19,219	14,409	33,063	49,806	79,200
Comet	13,781	11,099	5,192	36,735	5,192
Cadillac	13,287	10,472	14,081	35,543	37,628
Mercury	9,956	7,769	14,563	26,945	39,877
Chrysler	7,500	5,427	7,381	19,598	19,184
Studebaker	5,428	4,607	10,794	16,479	27,696
Lincoln	2,634	2,494	2,090	7,925	6,645
Imperial	928	797	1,500	2,848	4,379
Misc. Domestic	794	567	3,965	2,324	10,296
Foreign	34,067	26,772	50,310	86,433	133,498
Total—All Makes	480,067	374,877	586,669	1,268,507	1,520,963

NEW TRUCKS

Make	March 1961	February 1961	March 1960	Three Months 1961	Three Months 1960
Chevrolet	23,829	19,898	32,579	65,246	74,495
Ford	23,891	19,937	25,494	63,951	65,694
International	8,292	6,060	9,949	20,426	25,551
G. M. C.	5,618	4,615	7,343	15,405	18,493
Dodge	3,152	2,551	4,259	8,533	9,912
Volkswagen	2,314	1,495	2,992	5,400	7,321
Willys Truck	1,435	1,524	1,838	4,511	4,564
White	974	825	1,325	2,670	3,585
Willys Jeep	679	731	941	2,190	2,138
Mack	808	523	1,064	1,837	2,784
Studebaker	478	404	297	1,212	562
Diamond T	137	117	252	432	655
Brockway	105	66	119	228	297
All Others	775	576	1,255	1,975	3,396
Total—All Makes	72,487	59,322	89,627	194,116	217,449

* Compiled from official state records. Data property of R. L. Polk & Co. May not be copied, sold or reprinted without Polk permission.

AIRBRIEFS

By R. Raymond Kay
PACIFIC COAST EDITOR

During Fiscal 1962, the Defense Department will spend $43.8 billion. That's $1.3 billion over 1961.

Here's an up-to-date breakdown on the aerospace industry's share of the expenditures.

Major expenditures:	FISCAL YEAR 1961	FISCAL YEAR 1962
Aircraft and Missiles (Navy)	$ 254,100,000	$1,085,400,000
Missile Procurement (USAF)	2,574,200,000	2,979,000,000
Equipment and Missiles (Army)	1,483,400,000	1,746,000,000
Aircraft Procurement (USAF)	2,906,700,000	3,782,100,000

Research, development, test and evaluation in Fiscal 1962 will come to $4.5 billion vs $3.9 billion last year.

Also, Defense has "planned obligations," that is, placing of orders for the same major categories:

	FISCAL YEAR 1961	FISCAL YEAR 1962
Aircraft and Missiles (Navy)	$1,824,300,000	$2,121,100,000
Missile Procurement (USAF)	3,171,100,000	2,822,400,000
Equipment and Missiles (Army)	2,334,700,000	2,254,000,000
Aircraft Procurement (USAF)	4,355,200,000	3,442,300,000

Fast Production with Hot Dies

A six-hour forming job reduced to seven minutes!

A maker of titanium channel rings for an aircraft exhaust system reports this time slash. It's done with a die heated to a constant 1000 deg F plus a hydraulic die cushion held at room temperature.

The old method called for drop hammer dies, then stress relieving and trimming. With the heated die method, there's no need for stress relief and there's little post-forming trim. Tolerance of the heated die rings: 1/64 in.

Advantages of the method: high quality parts, material saving, cut in spoilage, better heat control in forming cycle. And, of course, speed.

More Education Needed

The engineer of the future must develop vast and complex machines and systems in fields which are unknown today. But he's probably not getting the education to equip him for the job.

That's the opinion of Dr. Allen B. Rosenstein of the University of California at Los Angeles engineering department's Educational Development Program. The program is a five-year study of UCLA's engineering curriculum. And, in fact, of the whole state of present and future engineering education.

"As an undergraduate, the engineering student gets a heavy dose of basic science. As a graduate, he concentrates on research, mainly in mathematics and the physical sciences. The big hold in his education is discipline of design," Dr. Rosenstein says.

"A design project may range all the way from developing a better pencil sharpener or weapons system, to meeting the problems of air pollution, salt water conversion, or public transportation.

"Only through a highly developed design skill," Dr. Rosenstein adds, "can the engineer rise above the narrow specialties and tackle problems in vast and yet uncharted fields."

Small Profits for Airlines

Last year, the domestic air lines took in more money than in any former year. But they made a net profit of only $1.1 million.

Stuart G. Tipton, president, Air Transport Association of America, says, "Normally the average corporation nets five cents profit out of each dollar of sales. The trunk airlines last year had to do $83 worth of business to produce the same nickel profit.

Quality Control

Quality and reliability are musts in today's complex weapon systems. What can be done to improve them?

Richard R. Nolan, Northrop Corp. Vice President and General Manager of the Norair Div., says management must play the key role in raising standards.

Mr. Nolan believes quality and reliability can be improved by a strong management program that calls for:

(1) A clear picture of the job spelled out to all departments.

(2) Improved worker attitude toward product integrity. And doing this with minimum penalty on cost and schedule.

(3) Better liaison between design and manufacturing.

Mr. Nolan says that unique communication problems come up between design and manufacturing. Today's low volume production under highly compressed time schedules is one of management's toughest nuts to crack.

Bright Future for Small Planes

Watch for sales of small or medium-size planes to double by 1965. And double again by 1970.

Sales last year in the U. S., says the Aerospace Industries Assn., hit $200 million. Today, some 70,000 small planes are in use for business, pleasure, or utility purposes.

The rosy forecast stems not only from the growing interest in this type plane, but in needed replacements. ■

News of the MACHINERY INDUSTRIES

Report on Study Just Completed by the Government Shows Position of U. S. Machine Tool Industry in World Trade. Exports of West Germany Exceeded U. S. Exports During 1955-58

By Charles A. Weinert

Government Reports World Status of Industry

The U. S. machine tool industry, world-wide, has had some stiff foreign competition during the past several years. While business with expanding markets abroad has been good, the American share has tended to diminish. At the same time, foreign machine tool builders have placed more of their exports in the U. S.

Historically, the U. S. machine tool industry has been the world's leading supplier of machine tools. This position no longer applies. Relatively-high wages and selling prices are the big problems. Nevertheless, the U. S. industry is still a large exporter.

U. S. sales abroad, so far, have held up reasonably well mainly because of two factors. One of these is superior technology — more-productive machines, or machines which could not be obtained anywhere else. The other is delivery. Some of the foreign machine builders, notably West German, are so heavily booked up with orders that foreign manufacturers in a number of cases are paying more in the U. S. to get machines in time.

While the overall situation as outlined above is well known, not many world-wide substantiating figures have been available. Some numerical data along this line are now presented in a report on a study just completed by the Government. It is entitled "World Trade in Metalworking Machine Tools," and was prepared by the Metalworking Equipment Division, Business and Defense Services Administration, U. S. Department of Commerce. Highlights of the report are being given below as a matter of information. Further details can be obtained from the report itself.

The report notes that the U. S. machine tool industry is a close second to that of West Germany as a world supplier — and that these two countries are far ahead of the other machine tool producers. It adds the comment, however, that U. S. producers are not only facing severe competition in many of their traditional foreign markets, but are confronted with increased competition from imports in this country. Also that that trend appears likely to continue.

The study primarily covered the years 1955-58, a period when many western countries and Japan were enlarging their production facilities. This period also marked the emergence of West Germany as the principal exporter of machine tools.

During these four years, West German machine tool exports totaled $685.8 million, and those from the U. S. amounted to $614.1 million—in the world total of $2.2 billion.

West Germany's 1958 exports were $199 million, and those of the U. S. $165.1 million. (For 1959, U. S. exports are given as $145.5 million.)

In the four-year period, the two countries accounted for nearly 60 per cent of world exports. Next in order came the United Kingdom and Switzerland — which almost equally-divided about 20 per cent.

Another interesting item is that U.S. imports for the four years approximated only 14.6 per cent of its export total—so this country remains one of the leading net exporters of machine tools.

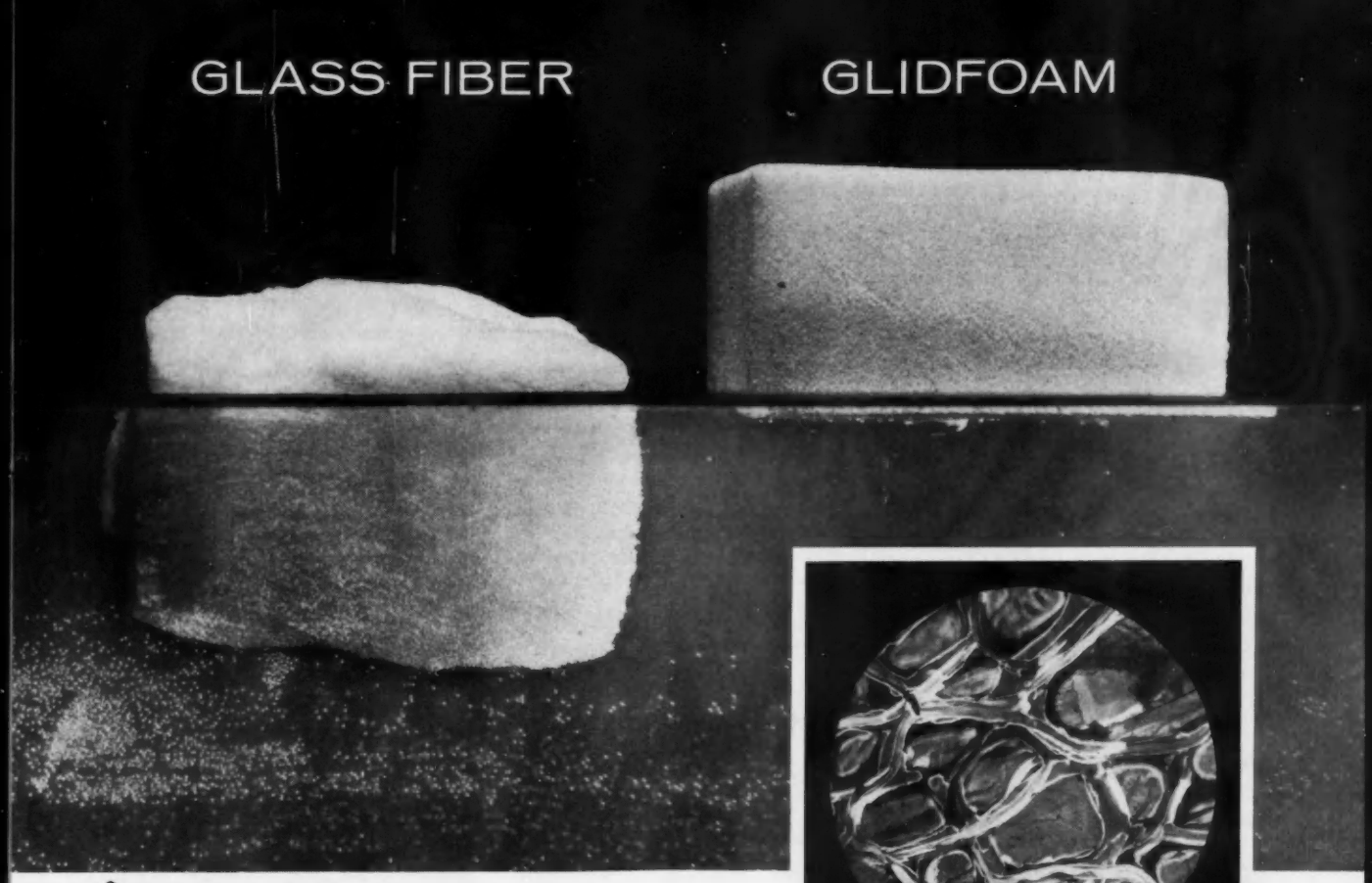
One development in this period, the report says, was the steady growth of the market for forming-type machines. On the other hand, the report indicates that cutting-type machine exports decreased.

A section of the report is devoted to the Soviet Bloc. While the data admittedly are incomplete, the report states they are believed to be of value as indicators of the nature and trend of the machine tool trade in these countries — Communist China, Czechoslovakia, East Germany, Hungary, Poland, and the U.S.S.R. The report shows that in 1958, trade with the Bloc amounted to 5 per cent of West Germany's total exports, 9 per cent of Switzerland's, 13.5 per cent of Italy's, and 11 per cent of Sweden's.

Czechoslovakia and the U.S.S.R. are the exporting members of the Bloc, and the report discloses that each made significant gains in the world market during the period 1955-58. Nearly 75 per cent of Russia's exports went to Bloc countries, but Czechoslovakia's shipments entered the U.S. to a limited extent, and minor gains were made in other Western Hemisphere markets.

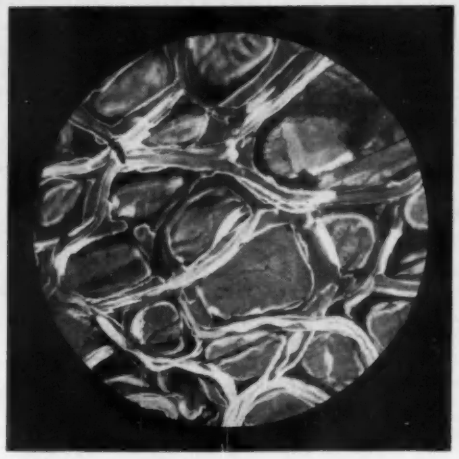
In conclusion, it should be pointed out that this study was undertaken by the Metalworking Equipment Division as a means of assisting U.S. machine tool producers in analyzing the world situation on machine tool purchases. (The report will undoubtedly also carry some weight in any evaluations made by Government agencies.) Copies of the complete report "World Trade in Metalworking Machine Tools" have therefore been made available, and may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at 70 cents each. ■

Circle 125 on Inquiry Card for more data ⟶



Glidfoam floats because its sealed-cell structure keeps out water. As demonstrated above in a 44-minute flotation test, Glidfoam absorbs far less moisture than glass fiber insulation.

Microphoto at right shows Glidfoam's tiny enclosed cells that provide an effective barrier to moisture and heat transmission.



GLIDFOAM* below-zero reefer insulation cuts moisture pickup, keeps payloads high

Reefers haul more payload, less dead weight, when insulated with Glidfoam poured-in-place polyurethane foam. Glidfoam's low moisture absorption has been proved in two years of regular over-the-road operation.

Because Glidfoam stays dry, its insulating efficiency stays high. This increases operating time, reduces unprofitable down-time for thaw or insulation replacement. Costly insulation maintenance is practically eliminated.

Glidfoam's low K-factor (.12 -.14) provides below-zero insulation with walls only half as thick as with conventional insulation. Cargo space can be increased as much as 500 cubic feet in a 40-foot trailer, payload raised several thousand pounds.

For better insulation in your reefers, specify Glidfoam, supplied as a complete ready-to-pour, two-component system.

QUALITY Glidden PRODUCTS

THE GLIDDEN COMPANY
INDUSTRIAL PAINT DIVISION
900 Union Commerce Building
Cleveland 14, Ohio

*Glidfoam is the trademark for Glidden polyurethane foam, registration applied for.

THE GLIDDEN COMPANY
Industrial Paint Division
900 Union Commerce Building, Cleveland 14, Ohio

Please send me complete information on Glidfoam poured-in-place polyurethane foam.

Name _____ *Title* _____

Company _____

Street _____

City _____ *Zone* ____ *State* _____

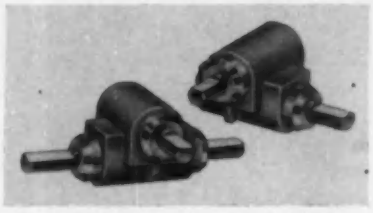
NEW PRODUCTION and PLANT EQUIPMENT

By C. J. Kelly
ASSISTANT EDITOR

FOR ADDITIONAL INFORMATION, please use reply card at back of issue

New Angle Drives

NEW angle drives have been provided with ¼ in. shafts which have a 1/16 in. flat for stronger attachment to a coupling end. Primarily used with flexible shafting, the new units are adaptable to a wide variety of appli-



cations other than flexible shafting.

They are constructed of aluminum alloy housing, steel gears and utilize oilite bearings. They have an ultimate static torque capacity of 25 lb in. with a backlash of 6 deg.

Model 9056HF-T weighs 4 oz and the 9056-119 (right) weighs 3½ oz. They are furnished in gear ratios of 1:1, and 2:1, with other ratios available upon special request.

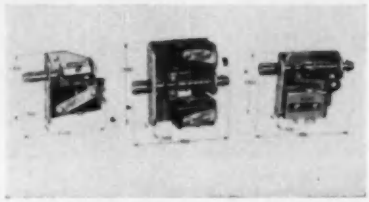
The F. W. Stewart Corp.

Circle 45 on Inquiry Card for more data

Interlock Switches

THREE new switches have been designed to cut current when the door of a cabinet or enclosure containing dangerous electrical equipment is opened. When the door is closed, the interlock automatically re-enerizes the circuit. For electrical checkouts the interlocks can be set to a maintained contact position. Three new series are available. One, the 13AC1, is designed for date processing consoles, transmitters and computers, since it eliminates even momentary power interruptions when the door is closed.

Up to 4 separate single-pole double-throw circuits can be controlled at one time with one 8AC1 series door



interlock. In such applications four subminiature precision switches are controlled by the actuating rod.

A sealed interlock is available in the 9AC series. The subminiature switches are sealed in an epoxy resin inside the housing, with an elastomer plunger seal bonded to the pin plunger and the metal housing.

Micro Switch Div., Minneapolis-Honeywell Regulator Co.

Circle 46 on Inquiry Card for more data

Internal Grinder Designed for Minature Size Work

MODEL 090A internal grinder has bee designed for close tolerance internal grinding of miniature work. The new unit provides a consistent repeatability within 0.00001 in. It features incremental wheel compensation which is infinite in a range from 0 to 0.001 in. The manufacturer reports that the sensitivity of this control can materially improve wheel life to an area of 1000 or more pieces per wheel. A direct reading digital dial shows the amount of wheel life remaining allowing operator to anticipate time of wheel change. *The Heald Machine Co.*

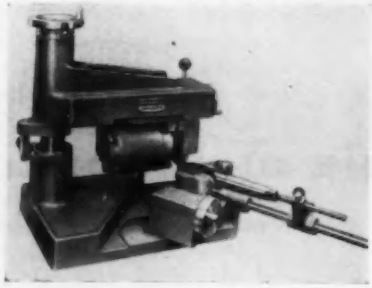
This new Heald Centri-Matic grinding machine has been designed for internal grinding of miniature size work. The range capacity is limited only by practical wheel size available at present. The work area on this unit is completely enclosed but may be readily accessible.

Circle 47 on Inquiry Card for more data

Drill Point Thinner

PRECISION drill point thinning operations can be performed on a compact, bench type, self contained motor driven unit. It will thin and center the points of ½ to 3 in. diameter. drills in lengths up to 24 in. in length.

The grinding wheel is mounted on the shaft of the motor. The drill is held at three points: by hardened



jaws on the leading edges of the flutes, just back of the cutting edges, and by an adjustable center at the end of the shank.

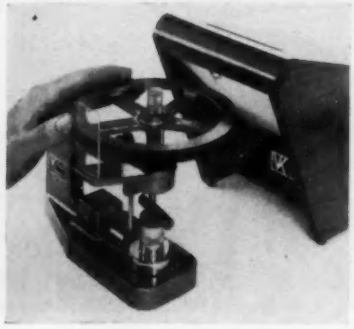
In operation, the machine grinds a groove of the proper depth on each side of the web. The drill is reset for each groove so that its axis is always in the same position. Micrometer adjustment is provided for setting the grinding wheel height. This device is equipped with a ½ hp 3450 rpm motor for operation on either 220/440 V, 60 cycle, 3 phase circuit or 110 V 60 cycle single phase lighting circuits.

Farrel-Birmingham Co., Inc.

Circle 48 on Inquiry Card for more data

Light Wave Micrometer

MODEL LWM-60 is the designation given a new precision measuring instrument. This new micrometer measuring device reads directly on the handwheel to 0.00010 in., and on the



vernier to 0.00001. It has a capacity of 0 to 2 in., and will measure such dimensions as the pitch diameter of threads and gears; check roundness; measure basic standards and numerous other applications. *Van Keuren Co.*

Circle 49 on Inquiry Card for more data

Spacing-Check System

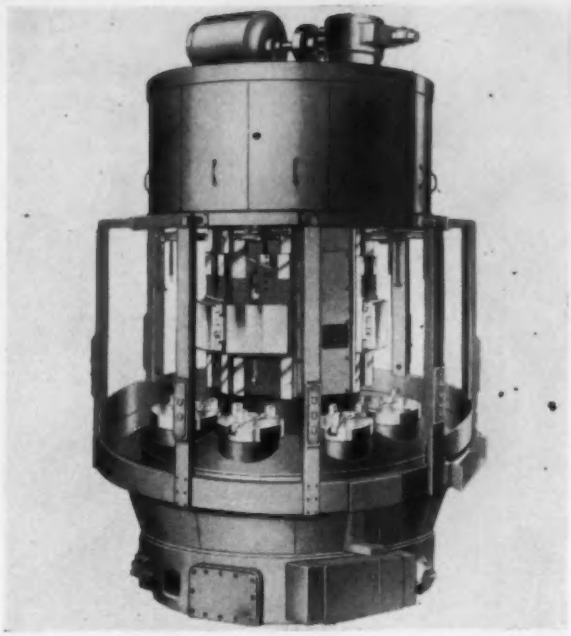
A SIMPLE tooth-space checking system and also graphically helps identify causes of tooth spacing errors in straight or helical gears and splines. According to the manufacturer this system provides a simple means of measuring pitch-line run-out and eliminating its effects on an index check.

The new system comprises a checker of new design, translucent charts and a light table. The new model is designed for production or laboratory use. *Michigan Tool Co.*

Circle 50 on Inquiry Card for more data

Multiple-Spindle Lathe Designed for Economy

This new type "M" Mult-Au-Matic Multiple spindle lathe has been developed to expand the line to cover the most advanced machine tool requirements. According to Bullard the price of the new unit is lower than other types of equipment that are capable of producing the same amount of pieces. The type "M" is 90 in. in dia. and stands 142⅜ in. from the floor. It is available in six, eight or twelve spindle models. Machine power is derived from an 18,000 rpm 60 hp maximum motor (ac or dc). The spindles are mounted on three anti-friction bearings to insure proper alignment at all times. Speeds of 400 rpm may be attained on six and eight spindle models, and 750 rpm on 12 spindle types. The Bullard Co.

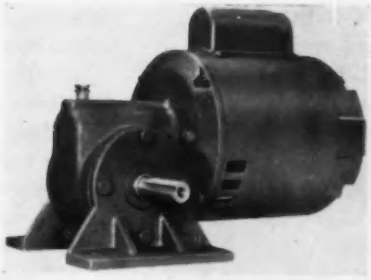


THIS machine is extremely rigid. Its rigidity is provided by a massive one-piece cast base which insures continued accurate alignment of the machine under all working conditions. For maximum indexing accuracy of the carrier, the mechanically operated lock pin is mounted on the outside perimeter of the base. The power chucking mechanism with high torque ranges is housed in the base. Chucking draw bar pressures are adjustable and easily set at the loading station.

Widely variable and independent spindle speeds, through the use of change gears, can be obtained at each work station. Feed rates can be varied at each station to suit machining requirements. This type of feed works is based on a cam feed principle. It is equipped with a safety device to protect against overload. Antifriction bearings are used throughout. *The Bullard Co.*

Circle 51 on Inquiry Card for more data

Right Angle Gearmotors



Weight reduction is a major feature of a new line of fractional right angle gearmotors. Available in a range of ⅛ through 1/3 hp, the line comes in drip proof, totally enclosed and fan cooled enclosures. Thirteen reduction ratios are offered as standard and the output shaft is reversible. Reliance Electric and Engineering Co.

Circle 52 on Inquiry Card for more data

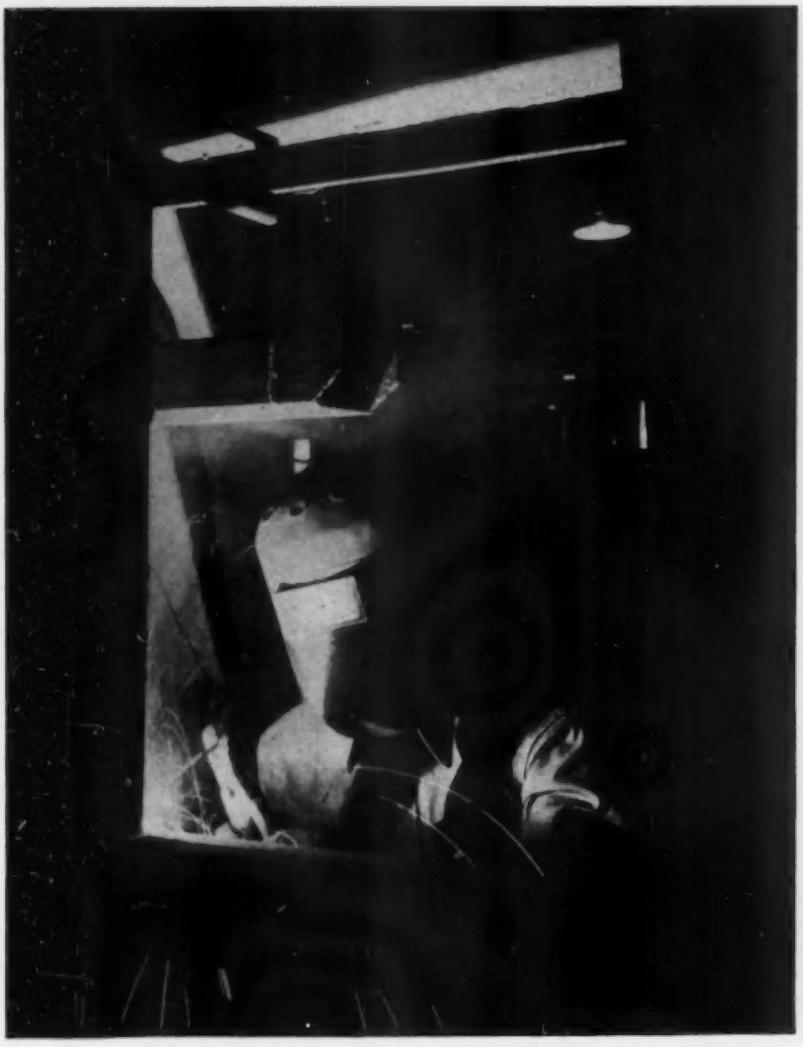
Optical Wheel Dresser

OPTIDRESS is the designation of a new optical wheel dresser that can be attached directly to practically any standard surface or tool and cutter grinding machine.

The unit has a built in 10X microscope with a radius reticle and a 6 min. vernier for accurately setting the diamond. Radius and two tangent angles may be dressed in a continuous motion. Micrometer cross slides are provided to permit the dressing of any combination of radii and angles into an intricate form on the wheel. Optical control eliminates "cut and dry" methods and assures a perfect blend between radii and angles, according to the manufacturer.—*Parker-Hartford Corp.*

Circle 53 on Inquiry Card for more data

(*Turn to page 62, please*)



Super-strong trailer built 2,850 pounds

This 32-ton trailer is a progressive example of how to get maximum strength with least weight and low cost. The main frame members are a wide-flange beam design built up by welding USS "T-1" Steel plates together. "T-1" Steel, with a minimum yield strength of 100,000 psi, has enabled the Engineering Department of Martin Trailer Division of the Hyster Company to design to approximately two times their normal static stress and still maintain adequate factors of safety.

Eight-foot cross members are formed channel sections of USS MAN-TEN High Strength Steel, which has a minimum yield point of 45,000 psi in thicknesses of ¾" and under. The combination of these two USS steels produced a weight saving of 2,850 pounds and represents a 21% decrease in dead weight of the unit.

Welding procedure. The "T-1" Constructional Alloy Steel beams are welded by submerged arc. The MAN-TEN Steel cross members are tack-welded to the main beams of "T-1" Steel, then finish welded by the shielded arc method.

"T-1" and MAN-TEN Steels pay off. The trailers are built by the Martin Trailer Division of the

lighter with USS "T-1" and MAN-TEN Steels

Hyster Company, Kewanee, Illinois. Mr. Rex A. McCormick, Assistant Sales Manager, says, "The end result of using extra-high yield strength steel is worth what it costs. Reception of the 'T-1' Steel units has been enthusiastic."

If you are building any equipment, mobile or stationary, that must be made stronger, lighter and more resistant to impact abrasion or corrosion, find out how these brands of special steel can help you—USS "T-1," MAN-TEN, COR-TEN, and TRI-TEN. All are weldable . . . all have special properties that result in longer service life and lower operating costs.

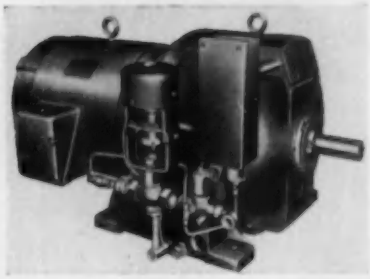
USS, "T-1", COR-TEN, MAN-TEN and TRI-TEN are registered trademarks

United States Steel Corporation—Pittsburgh
American Steel & Wire—Cleveland
Columbia-Geneva Steel—San Francisco
National Tube Division—Pittsburgh
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

 (Continued from page 59)

New Drive Units



A new line of Dynaspede drives have been introduced to offer industry a compact, high hp unit for wide application. The manufacturer reports the new drives are a result of a long range research and development. Eaton Mfg. Co.

Circle 54 on Inquiry Card for more data

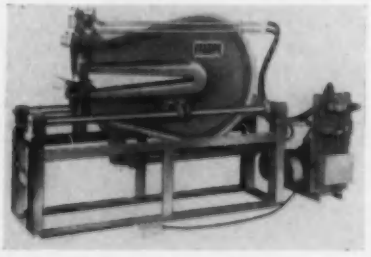
Arc Welding Package

STAINLESS and mild steels and aluminum can be welded with a new, low cost gas-shielded metal arc welding package. The complete unit included a model AH20-E Aircomatic MIGet gun and the new MIGet CAV power source. No separate controls are needed for the package. A single control on the power source adjusts arc voltage while a knob on the gun adjusts wire feed speed. Rated at 200 amperes dc, the 60 pct duty cycle power source has an overall length of 34½ in. It is 23¾ in. high and 19½ in. wide. *Air Reduction Sales Co., Div. of Air Reduction Co., Inc.*

Circle 55 on Inquiry Card for more data

New Metal Punch

BURR free test samples have been produced from 0.075 in. mild steel in one second punching cycle by a newly developed punch. Called the model MP-336, this unit develops a



35-ton thrust with double acting hydraulic cylinder for positive stripping.

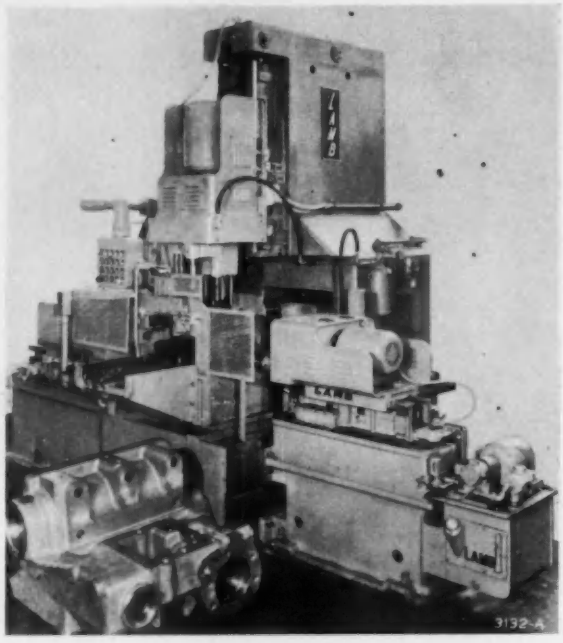
The 4200 lb punch has a reach of 36 in. Its C frame is mounted on slide bars with 42 in. traverse into the strip line. Total traverse time in and out is 20 seconds. *Manco Mfg. Co.*

Circle 56 on Inquiry Card for more data

4-Way Machine has Tunnel Type Column

One vertical and three horizontal way units, drill, chamfer, spotface and form valve seats in tractor power lift housings. The vertical column is a tunnel type. It straddles one of the horizontal slide units, eliminating the need for an additional machine to spotface and chamfer one hole in the part. The unusual column is designed to provide easy access to the horizontal slide controls for service and adjustments. The production rate on this part is 32 pieces per hour. The machine is comprised of standard building blocks and was designed specifically for quick conversion. F. Jos. Lamb Co.

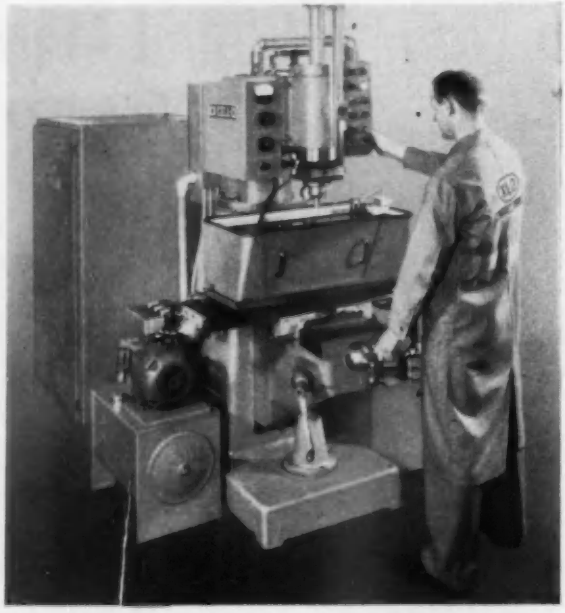
Circle 57 on Inquiry Card for more data



New Machine Removes Metal by Electrical Discharge

A NEW machine, designed to depart from the conventional metal cutting processes, has been developed and tested. According to the manufacturer, the new unit has reduced production time on an aircraft part from 40 minutes to eight minutes. Tooling and fixturing are reported to be simpler and less expensive. In this electrical discharge process both the tool and the workpiece are submerged in a dielectric fluid. In operation the tool, or electrode, is fed into close proximity with the work to be processed. The controlled removal of metal is accomplished by a series of momentary heavy electrical discharges across the gap between the part and the tool. At the conclusion of the work cycle an inverse image of the tool is formed on the part. *Ex-Cell-O Corp.*

Circle 58 on Inquiry Card for more data



This machine, called the Lectra-Form, utilizes an electrical discharge process to remove metal. According to the manufacturer this unit will perform many machining operations otherwise considered impractical by conventional methods. It will form hardened metals, tough materials and intricate shapes.

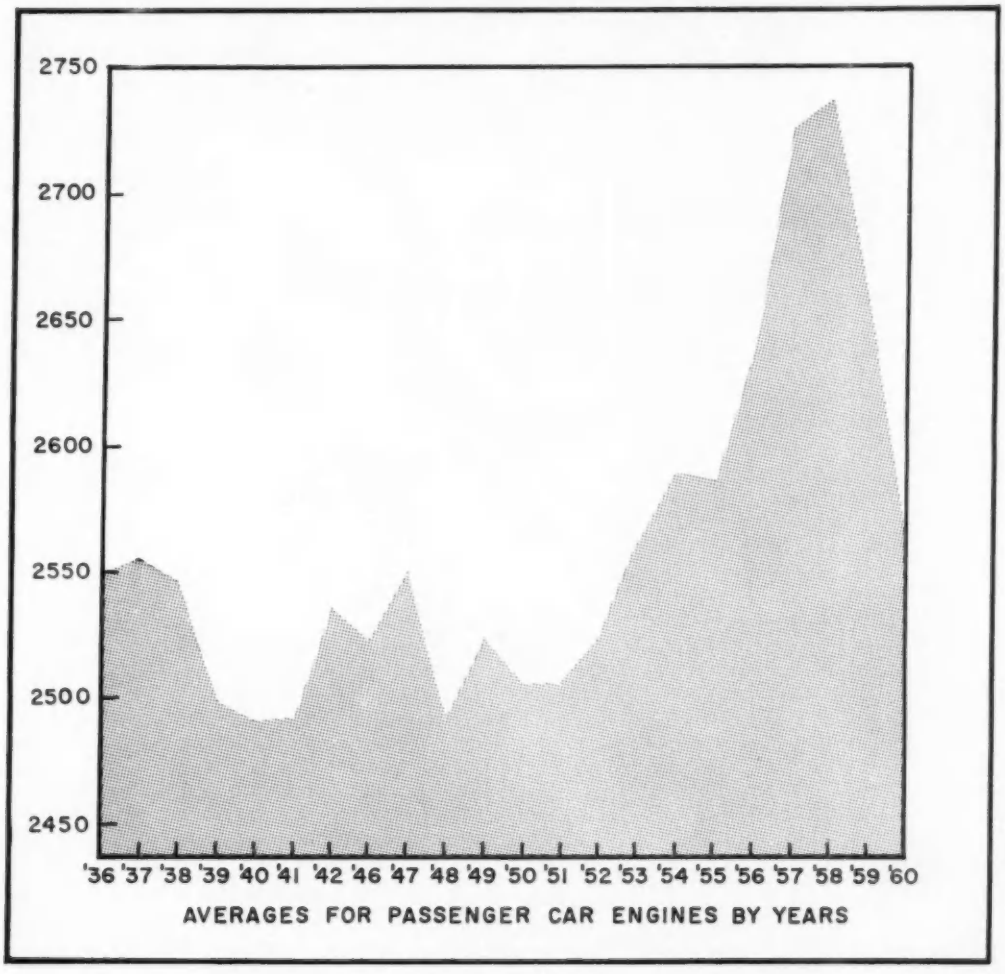
Circle 127 on Inquiry Card for more data ⟶

A. I. / AUTO-TECHNICS DATA SHEETS

Basic Automotive Design and Production

TECHNICAL DATA FOR PERMANENT REFERENCE

Average Piston Speeds, 1936-1960



Average Piston Speeds (Ft. per Min.)

1936	2498	1950	2505
1937	2554	1951	2505
1938	2545	1952	2523
1939	2498	1953	2560
1940	2490	1954	2589
1941	2492	1955	2585
1942	2534	1956	2634
1946	2522	1957	2724
1947	2550	1958	2735
1948	2492	1959	2651
1949	2522	1960	2559

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DESIGN FLEXIBILITY...

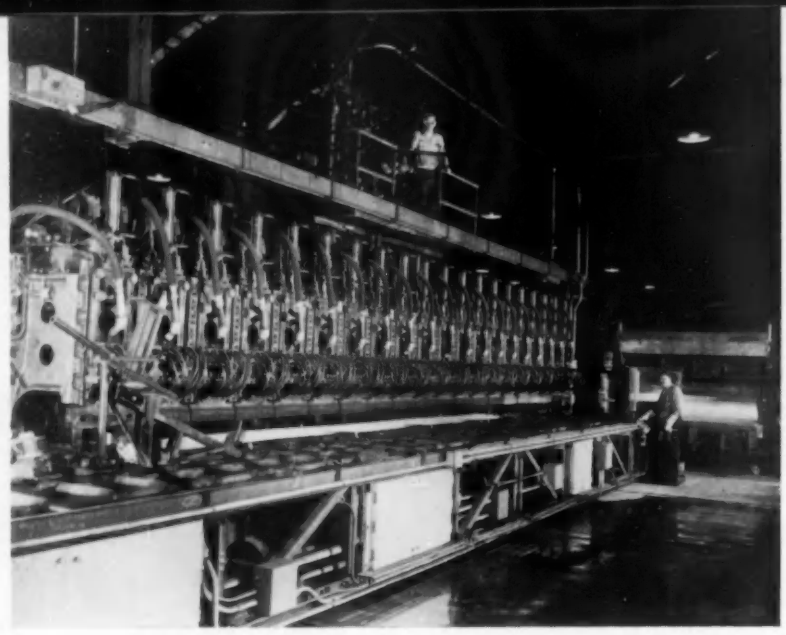
THAT'S THE BEAUTY OF STEEL

Car owners prefer steel for safety and the strength that lets it keep its good looks. Automotive designers appreciate its freedom of design, the fact that it permits deeper draws and more intricate forming than lighter metals such as aluminum. Production engineers recognize its superior fabricating qualities and know that steel polishing costs are far less.

When it comes to bumpers (or other parts that require strength, design flexibility and low manufacturing costs), steel is stronger—looks better longer. Great Lakes Steel Corporation, Detroit 29, Michigan.

That's the beauty of Steel

GREAT LAKES STEEL *is a division of* NATIONAL STEEL CORPORATION



Front view of the A. O. Smith Corporation's die quench machine, capable of quenching and straightening truck and trailer side rails up to 40 ft in length.

Die Quenching Machine for Chassis Frame Side Rails

As a move to produce lighter, stronger truck frame members at the lowest possible cost, A. O. Smith Corp., Milwaukee, has developed a die quenching machine that hardens side rails without distortion. A special steel, selected because it has excellent hardenability at only a small price premium, is used for the new process. Truck frame side rails can be turned out with a minimum yield strength of 110,000 psi.

The die quenching process is an outgrowth of the trucking industry's demand for greater payloads in its transportation equipment, and therefore for higher strength structural members of lighter weight. A. O. Smith had been supplying heat treated steel truck frames to the industry for some years, but the problem of removing distortion after heat treating had made the frames costly. Distortion could be mimimized by use of such alloy steels as AISI 8620, but the materials cost then rose. Mill hardened steel members did not provide a satisfactory answer, because the side rails are frequently tapered or curved in some parts of their length, and the mill hardened steel of uniform cross-section could not be reformed without first annealing.

Smith engineers, confident that the distortion problem could be solved, set about studying the low cost steels with good heat treat response, and finally hit upon a modified AISI 1027 steel as the best. This steel, with carbon content of 0.22-0.30 percent, manganese 1.00-1.30 per cent, contains no nickel nor chromium, and carries a price premium of only 16 per cent. It has good weldability, an important factor for this application, as the truck frames are shipped knocked down and are assembled by the truck builder, frequently with some welding.

To eliminate the twist, bend, bow, and camber that had caused difficulties in earlier heat treated side rails, a quenching fixture was developed in which the member, of channel cross-section, rested on a steel base and against a steel buttressing piece, while a movable steel member closed to complete the restraint on three sides. Another steel device fitted inside the channel throughout its length, and expanded to press against the three inside surfaces. In addition to the quenching effect of the cold steel of the fixture, water was conveyed to the fixture and the fixture surfaces were channeled to flood all parts of the workpiece. By this method of quenching under restraint, the workpiece was hardened without harmful distortion.

In the die quenching machine as finally developed, the truck side rails, formed from steel plate, are heated to 1650 F for 30 min in a furnace. A transfer mechanism, moving on rails that run parallel to the face of the furnace, is positioned, the furnace door is opened, a grasping device on the transfer mechanism reaches into the furnace and closes on the end of one of the channels, moves rapidly back along the transfer mechanism and so draws the channel out of the furnace to rest on the frame of the transfer unit. These motions are controlled by an operator who rides the transfer mechanism. The transfer device then moves on its rails for about 10 ft to carry the yellow-hot side rail to the quenching fixture. Knockout rods push the side rail into position in the quenching fixture, the movable steel base member closes, and the inside fixture moves down to fill the channel member. Water is immediately flooded into the fixture to quench the steel. After about half a minute the quenching fixture is opened, the side rail is pushed out by knockout rods, and permitted to drain.

Hardness of the quenched member is about 429 Brinell, and the tensile strength is about 217,000 psi. Before quenching the formed steel side rail had a hardness of about 163 Brinell and a tensile strength of about 79,000 psi. The hardness is then drawn back to about 255 Brinell by tempering at 950 to 1020 F. The resulting yield strength is about 117,000 psi, and a minimum of 110,000 psi can be set. The ultimate tensile strength of these tempered pieces is about 127,500 psi average. ■

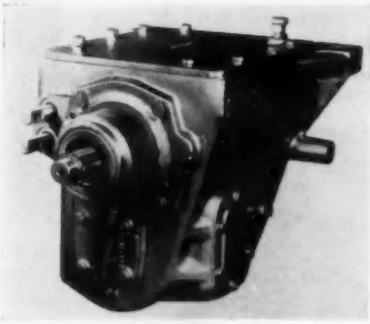
NEW PRODUCTS AUTOMOTIVE-AVIATION

FOR ADDITIONAL INFORMATION, please use reply card at back of issue

By C. J. Kelly
ASSISTANT EDITOR

Auxiliary Transmission

A recently introduced auxiliary transmission has a nominal torque rating of 550-600 ft lbs. This unit, known as the Spicer model 7041, weighs 340 lb and has an overall length of 25 3/16 in.



Designed for use with standard four or five-speed transmissions in the 400-600 ft lbs capacity range, the model 7041 has excellent ratio splits in the top three gears. Shifting is accomplished at the same rpm in these splitter gear positions resulting in complete utilization of maximum engine horsepower during shifts.

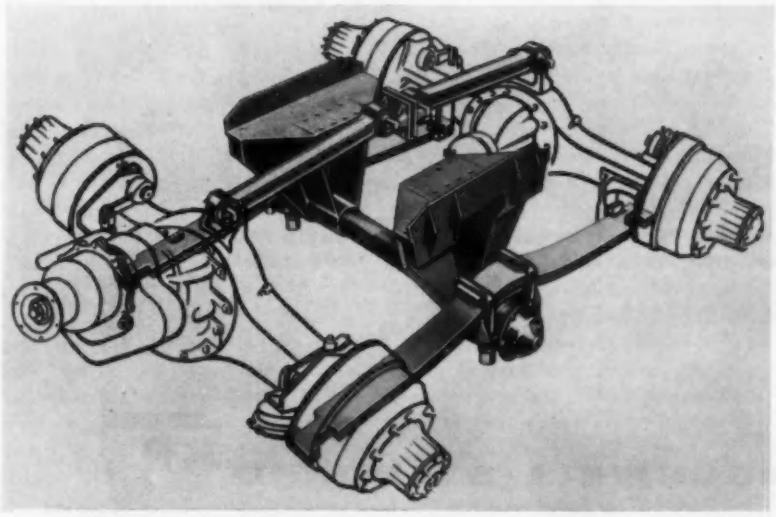
A Spicer top-mount power take-off, developed specifically for the model 7041 auxiliary, is available to operators of heavy-duty winches, pumps and other vehicle-mounted materials handling devices requiring full engine torque. *Dana Corp.*

Circle 70 on Inquiry Card for more data

New Tandem Suspension System for Trucks

With this exclusive new design, each spring consists of but two leaves of equal length. In these leaves, the thickness at the center is increased to the point where the section modulus, or bending strength, is equal to that of a multi-leaf spring. Each leaf then tapers gradually toward the ends keeping the same strength as a multi-leaf spring. This Taper-Leaf Suspension, according to Rockwell engineers, achieves the same load-carrying capacity with two leaves that standard suspensions carry with multiple leaves. The spring leaves are supported and are free to "rock" without twisting strains when one axle passes over an obstruction. *Rockwell Standard Corp.*

Circle 71 on Inquiry Card for more data

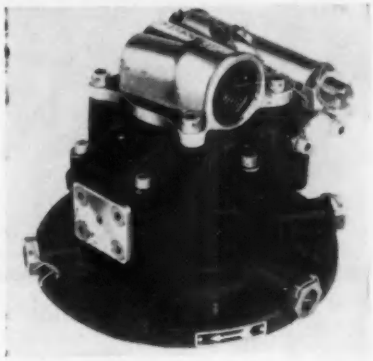


"Taper-Leaf" is the name given this new suspension system. It is the result of more than 20 years of development work, the manufacturer reported. This system is designed to give trucks a cushioned comfortable ride, loaded or unloaded. Rockwell Standard Corp.

Airborne Hydraulic Pump

Known as the AP2V, a new airborne hydraulic pump is reported to deliver approximately 10 gpm at 6000 rpm and 3000 psi, with a maximum displacement of 0.40 cu in. per revolution. Weight of the pump is 6.5 lbs.

This device is a single-stage, variable volume, cam actuated pump with pressure compensator control. Response characteristics meet and exceed those required by MIL-P-25868 and MIL-P-19692. Volumetric efficiency is over 95 pct through a pressure range up to 300 psi.



All rotating parts on this unit are hydraulically balanced and the pump does not require either a universal drive or anti-friction thrust type bearings. *American Brake Shoe Co.*

Circle 72 on Inquiry Card for more data

90 Deg Gear Box

A completely enclosed 90 deg gear box had been designed for making sharp bends in rotary-type remote control linkages. The unit consists of a cast bronze housing and two spindles with bevel gears supported in needle bearings.

This new gear box is available in three different sizes with torque capacities from 500 to 3500 lb, and is reported to be 88 pct efficient. The spindle stub shafts are available either keyed or splined in whatever diameter is required for a particular application. *Stow Mfg. Co.*

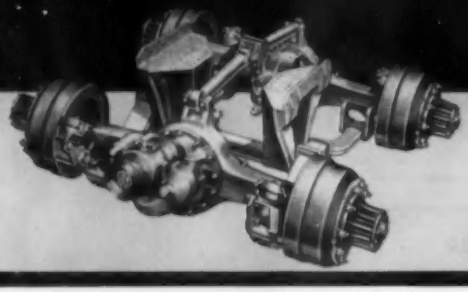
Circle 73 on Inquiry Card for more data

there's a ROCKWELL-STANDARD Driving Tandem for every kind of service

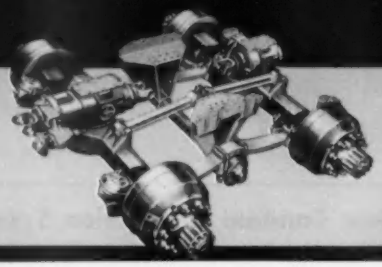
First developed by Rockwell in 1918, driving tandems offer four important advantages over single driving axles... *greater legal payload... greater traction... better flotation... smoother riding!*

Today, only Rockwell-Standard offers a complete line of driving tandem axles to meet every on-or-off highway need. Capacities are available in a range from 22,000 to 150,000 pounds—with axle ratio selection exceeding anything offered elsewhere in the industry.

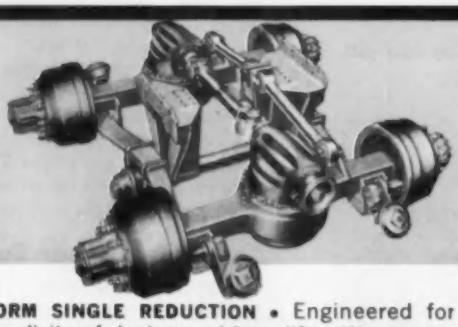
One of the four types of driving tandems below is ideally suited for your particular requirements:



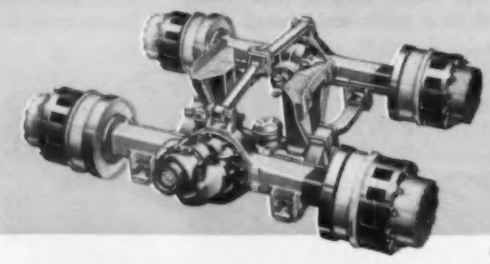
HYPOID SINGLE REDUCTION • Engineered for minimum weight and cost • Husky hypoid gearing for maximum gear strength • Axle ratios up to 8.6 to 1 • Nine models with capacities to 46,000 pounds.



HYPOID-HELICAL DOUBLE REDUCTION • Engineered for universal heavy-duty operations • Balanced hypoid-helical double reduction gearing • Wide selection of ratios • Six models with capacities up to 65,000 pounds.



WORM SINGLE REDUCTION • Engineered for simplicity of design and long life • Worm gear may be reversed to increase operating life • Four models with capacities up to 50,000 pounds.



FULL PLANETARY DOUBLE REDUCTION • Engineered for extra heavy-duty operations • Planetary reduction is at wheel end for greatest mechanical advantage • Capacities up to 150,000 pounds.

Products of... **ROCKWELL-STANDARD CORPORATION**

ROCKWELL R STANDARD ®

Transmission and Axle Division, Detroit 32, Michigan

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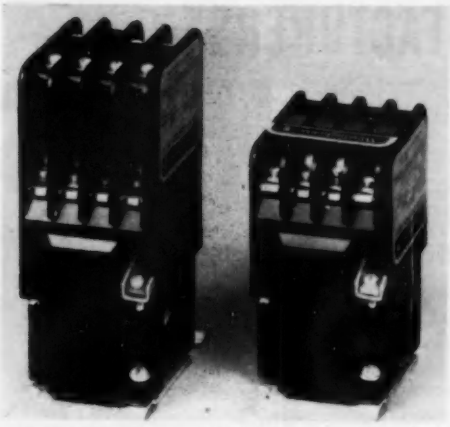


Fig. 6—Four-pole and eight-pole "small" relays

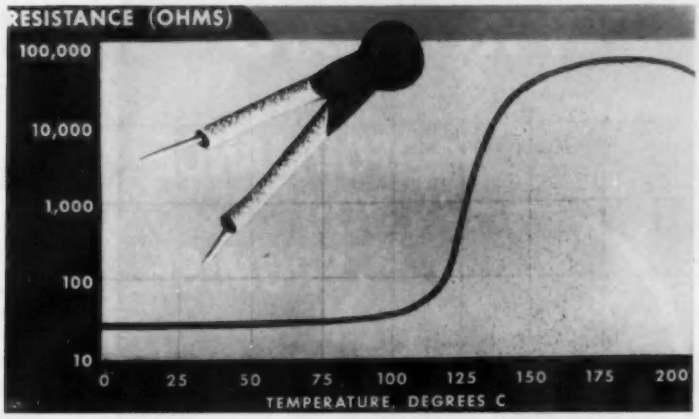


Fig. 7—Resistance versus temperature curve of PTC thermistor

MACHINE TOOL FORUM

(*Continued from page 37*)

sion; to from all n-o to four n-o and four n-c on the eight-pole version. Required panel space is 1-11/16 by 3⅛ in.

Accelerated tests with 12 relays of the latter type showed one relay failure after about two million operations, a second at a little more than 11 million operations, and a third failure after about 14.5 million operations—with the remaining nine relays still working at test discontinuance after 20 million operations.

Mr. Zambrzycki said that thus far Ford was using only relays of the four and eight-pole construction with non-reversible contacts. They were applied on installations where no space was available for standard panel construction. These "small" relays reduced the length of the control enclosures from 32 to 20 ft in one case, and from 28 to 18 ft in another case.

The speaker stated that since none of the machines with the "small" relays was yet in operation, he was unable to present a field report. By the same token, neither are the relays approved for company use. He emphasized, however, that he and his associates in Ford's Engine and Foundry Div. "believe the 'small' relay is the best approach to attacking the panel enclosure growth problem."

Motor Protection

Typical applications of motors with a novel built-in thermal protection were outlined by T. T. Robinson and J. W. Hastings, Motor and Gearing Dept., Westinghouse Electric Corp.

The motors, named Guardistor, are fitted with thermistors which have a "positive temperature coefficient." The thermistors, usually three connected in series, are embedded in the motor windings. This device has a relatively constant resistance of about 30 ohms over a wide temperature range. But when its critical design temperature is reached, its resistance sharply rises many times (Fig. 7). It is this characteristic which is utilized in a resistance bridge or relay circuit to govern the motor control.

The basic circuit components consist of a small transformer, two silicon diodes, and a normally-open relay. Control electric power is transformed to about 30-v a-c, and then rectified to d-c by the diodes before going to the thermistors and d-c relay coil. Sufficient current to energize the relay coil and hold in the contacts will flow as long as all the thermistors remain below their critical design temperature. However, if any one of the thermistors senses an overheated winding, its resistance value rapidly increases, reducing the current flow and causing the relay to drop out and open the contactor. The motor cannot be re-started until its windings again reach a safe value.

Up until about a year ago, experience in the field on the Guardistor was mostly limited to built-in motors of hermetically-sealed air conditioning compressors. The authors reported that since then, data received on general-purpose applications indicate a wide potential for its use in machine tools.

One of the newer applications was in a 75-hp motor where each operating cycle consisted of two seconds "on" in a forward direction, two seconds "off," two seconds "on" in a reverse direction and two seconds "off." During an elapsed time of 463 hours of operation, 167,473 reversals took place; and the thermistors acted 192 times. Inspection of the motor's stator winding after this severe duty showed no damage from heating.

Additional applications were cited, including installations involving high-inertia loads with relatively long-period acceleration; wide variations in both ambient temperature and motor loads; and portable high-speed grinders in continuous operation.

During the discussion which followed this paper, a question was raised from the audience as to whether the thermistors might not also be applied as temperature-sensing elements in cabinets. The reply was not too definite. However, it was revealed that thermistors with break-over temperatures of 110, 130, and 150 C were now being made, and that one of 85 C was under development.

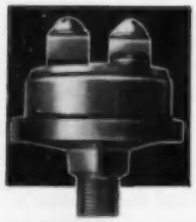
(*Turn to page 73, please*)

Hobbs HOUR METERS

ASSURE "ON TIME" MAINTENANCE

A recommended program of planned maintenance based on OPERATING TIME promotes better care of your product through correct attention at the right time — helps protect its reputation for top performance and dependability.

HOBBS HOUR METER is a true electric timing instrument which shows operating time in hours and minutes. No revolution counter can give a reliable indication of total engine time in all speed ranges. These efficient elapsed time indicators can also provide a realistic basis for buying and selling used equipment — show the actual running time of leased equipment. Ideal for warranties and service contracts. Models available for Alternating Current and Direct Current.



COMPLETE LINE OF PRESSURE SWITCHES

Industry approved for a wide range of applications — single circuit and dual circuit; grounded and non-grounded; preset pressure ranges of from 3 to 60 psi. Pretested at 150 psi.

Also manufacturers of shock-mounted head, tail and dash lights for off-the-highway equipment.

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Circle 129 on Inquiry Card for more data

MANUFACTURERS' NEWS

New Nickel Project Opens

Commercial production of refined nickel has started at the Thompson, Manitoba, project of the International Nickel Co. of Canada, Ltd. The $185 million Thompson project will increase Inco's production capacity by more than 75 million lb. The refinery employs a new process developed by Inco research scientists and engineers. The nickel company has built the nearby town of Thompson at a cost of $8.5 million. At present there are 1800 employes in the plant. This number will increase soon to 2300. The town has been planned to accommodate 8000.

Modine Plant Under Way

Modine Mfg. Co. has announced it is building a 30,000 sq ft plant at McHenry, Ill. The initial factory unit is expected to be part of a 170,000 sq ft series of buildings, A. G. Dixon, Modine president, reported. The one-story building is expected to be ready for occupancy by fall.

Midland-Ross Acquires Firm

Shareholders of Midland-Ross Corp. and Industrial Rayon Corp. have approved merger plans. Terms of the merger agreement approved by directors of both companies provide that each of the 1,851,255 common shares of Industrial Rayon stock will be converted into two-fifths of a share of Midland-Ross common. Industrial Rayon will operate as a division of Midland-Ross. Frederick L. Bissinger, Industrial Rayon president, will become a group vice president and will continue to direct Industrial Rayon's activities.

Eaton Acquires Dill Mfg.

Eaton Mfg. Co. has acquired substantially all the assets of the Dill Mfg. Co., tire valve producer, for 200,000 shares of Eaton stock. The acquisition cost about $7.4 million. John C. Virden, Eaton president, said the acquisition was another move in Eaton's planned diversification program aimed at a broadening of Eaton's markets. Dill will be operated as an Eaton subsidiary with no changes in management, Mr. Virden declared.

Goodyear Expansion

Goodyear Tire & Rubber Co. will spend $2 million for expansion and improvements at its industrial belt plant in Lincoln, Neb. The five-year program will begin immediately with erection of a $400,000 addition to the plant.

ON OUR WASHINGTON WIRE

Metalworking industries involved in defense production should pay close attention to the greater emphasis being put on conventional weapons for fighting limited wars. Though they seem outdated by modern missiles and nuclear arms, conventional weapons will be around for a long time. They will be improved, like the four-man submarine being developed by the Navy or the helicopters ordered by the Army which can transport 33 soldiers or carry three tons of cargo.

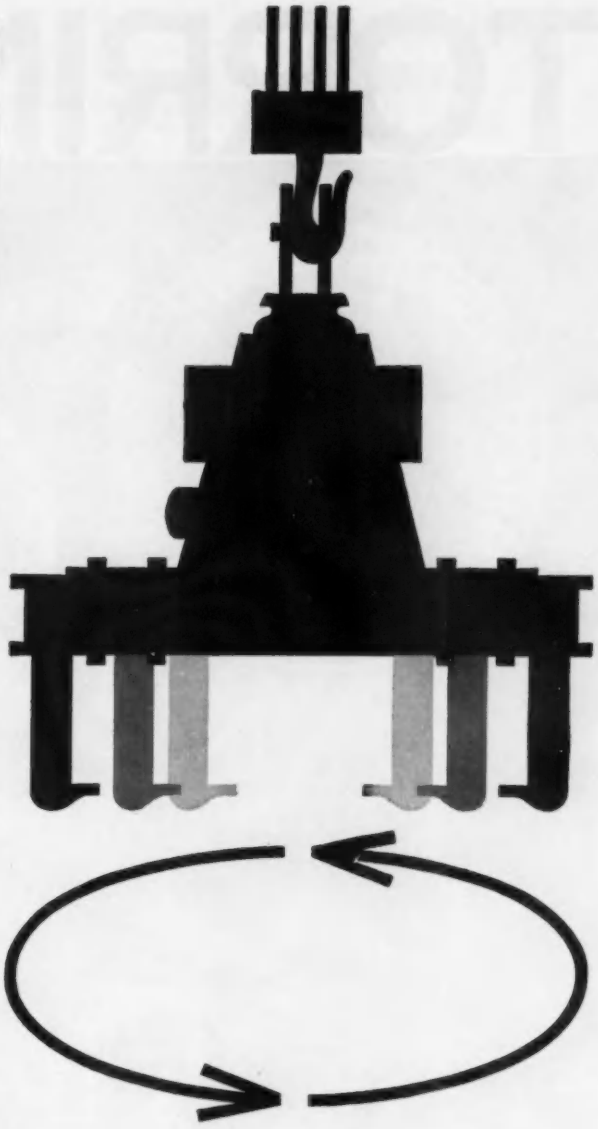
The General Accounting Office, the Federal spending watchdog, may get the power to look at the books of private companies entering into negotiated contracts with the Government. Sen. John L. McClellan (D., Ark.) has asked the GAO to tell Congress what legislation is needed to allow a look at company books.

Responsibility for purchase of all nonmilitary supplies will be transferred from the Defense Dept. to the Government's housekeeping agency, the General Services Administration. This will be completed in 1963. Some 1.2 million items, including automotive supplies, hardware and hand tools, and office equipment are involved.

Congress may authorize the Secretary of the Interior to survey all Government-owned land in a search for strategic minerals. The 10-year survey is suggested by Sen. Lee Metcalf (D., Mont.) who says it would cover all Federally-owned lands. He has submitted a bill to authorize the survey.

An office may be set up soon in the Commerce Dept. to promote foreign investment in U. S. industry. The new office is Commerce Secretary Luther A. Hodges' idea. He seeks $225,000 from Congress to set up an office to assist foreign investors with special problems of doing business in the U. S., such as taxes, corporation laws and labor regulations. The plan is designed to get more balance between what the U. S. spends abroad and what foreign countries spend here.

Expected enactment of an expanded water pollution control bill will affect industry several ways. The act would double the $50 million a year Federal funds for construction of sewage facilities. On the other hand, it would permit a Federal crackdown on industries polluting lakes or streams.



Safely—quickly—efficiently ... Heppenstall can handle it

TIGHT SQUEEZE?... Clearance a limiting factor in your plant? Heppenstall's Rotating Coil Tongs lift, rotate and stop at any position through 360°. Motorized arms move to maximum and minimum openings to your particular specification.

Heppenstall tongs meet current demands of today's automotive industry. For more specific information call or write us direct.

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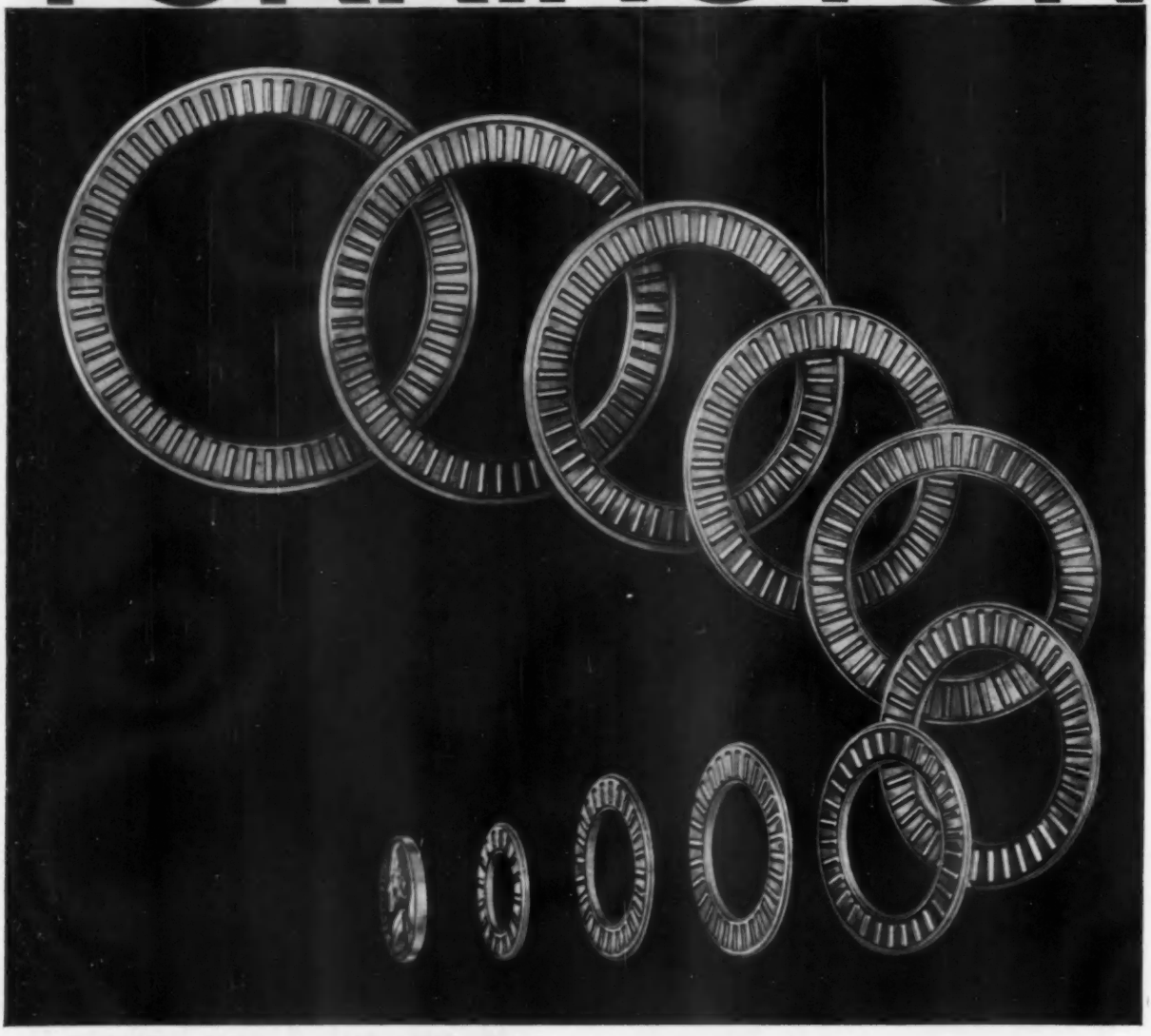
TORRINGTON



SEE WHAT YOU GET IN A BEARING NO THICKER THAN A NICKEL

Torrington Needle Thrust Bearings offer true anti-friction operation, high thrust capacity, wide size range, low unit cost...all in a unit no thicker than a nickel or ordinary thrust washer.

That's not all! These exceptional bearings have an O.D. much smaller for a given shaft size than any other type of thrust bearing. You can run them on hardened and ground surfaces, or on standard races. They're completely self-contained . . . can be easily handled and installed.

Remember Torrington Needle Thrust Bearings next time you need better performance in a restricted space. Call or write us for more information.

RACES IF YOU WANT THEM
Standard races are available. Otherwise Torrington Needle Thrust Bearings may be run directly on hardened and ground adjacent surfaces.

progress through precision

THE TORRINGTON COMPANY

TORRINGTON BEARINGS

Torrington, Connecticut • South Bend 21, Indiana

Circle 131 on Inquiry Card for more data

Machining Axle Housings at Deere

(*Continued from page* 53)

chine, and the bottom face is rough milled on a Kearney & Trecker vertical mill. For the next operation a Sundstrand mill has been converted into a multi-operation machine by attaching an air drill to it, so that both ends of the cylinder head are milled and two holes, one 0.190-in., the other 3/16-in., are drilled in the top.

On another combination of a Sundstrand mill and an air drill, four radius slots for the rocker arm shafts are milled in the head casting, and a 7/32-in. hole is drilled on an angle in the rear end of the piece. A two-way Footburt machine drills 18 holes for cap screws from both sides, and eight holes for valve guides. In the second station on this machine, 14 bosses are spotfaced, nine miscellaneous holes are drilled, and four locating holes are reamed.

Miscellaneous holes on the top, on the manifold side, and five holes on the front are drilled on a Natco two-way drilling machine. Eight holes for the spring seat are then counterbored 1-7/16-in. in diameter on the top of the cylinder head, eight valve throats are rough bored and spotfaced, and a previously drilled oil hole is reamed with an auxiliary air feed head, all on a Footburt machine. Another Footburt drills, chamfers, counterbores, and reams four injector nozzle holes. The fourth Footburt on the line machines radius cuts near four intake valve ports and drills four injection nozzle clamp holes.

The bottom face is then finish milled on a Kearney & Trecker milling machine. A Footburt two-way tapper taps the injector clamp holes, holes for attaching the manifold, and miscellaneous holes, 32 in all. Other miscellaneous holes in the top and bottom of the casting are chamfered, tapped, and reamed on a Hammond tapper. Eight holes for valve guides are then gun bored, and eight valve throats are counterbored and finish bored on a Footburt machine.

The cylinder head is air tested for leaks in a tank. Valve guides are pressed in on a Hannifin press, and two pins are driven in. These guides are then finish bored and the valve seats are finish cut on a Footburt gun boring machine. The cylinder head is then washed in a Magnus washer, rinsed, and blown off. Head holes and combustion chambers are burred and blown out, and the expansion plug is driven in. The cylinder head then is ready to move to engine assembly. ■

Automatic Machining at Evinrude

(*Continued from page* 43)

pin and crank bores.

At the first station the rods are checked for presence and position. The second station breaks the cap from the rod along the line of weakness produced by the series of fracture holes. This operation is unique in an assembly machine, and was devised to duplicate the procedure formerly used as a part of manual assembly. Tapered pins in a machine head are driven into the four fracture holes to break the cap from the rod. The third station checks the rod for completeness of fracture. Screws are fed down to the next station in vertical channels that bring them to the operation in proper position for torquing into the rod to join the cap to it. Torque is controlled to the proper force for each size of rod.

The fifth station is inoperative, and available for later changes in processing. The sixth station provides for the insertion and torquing of another size machine screws than those used at Station No. 4 when other size rods are run. Station No. 7 is inoperative, and at Station No. 8 the assembled rod is lifted off the fixture and dropped down a chute. A gate in the chute, controlled automatically from the machine, channels correct assemblies to a tote box; improperly assembled or defective pieces, as indicated by the checking on the machine, are automatically routed to a reject box. These pieces may be withdrawn later for rework or scrapping.

After assembly, several finishing operations and cleaning are performed on the joined rod and cap.

MACHINE TOOL FORUM

(*Continued from page* 69)

Static Converter Drives

Looking toward still-better adjustable-speed drives employing adjustable-frequency a-c synchronous motors, work has been done on developing adjustable-frequency power supplies. The status of power supplies of this type was reported in a paper co-authored by Lon Stringer and Ian Macdonald, Systems Control Dept., Westinghouse Electric Corp.

The authors mentioned that the introduction of high-power semiconductor switching devices, such as high-gain silicon power transistors and Trinister controlled rectifiers, has made possible the development of satisfactory static, adjustable - frequency power supplies.

The power supplies built so far are comprised of two basic units. One of these is a rectifier for converting fixed-frequency a-c power into d-c power. The other unit is an inverter for converting the d-c power into a-c power of variable frequency.

The authors advised that two static converter drives rated at 9 and 18 kva, and using germanium transistors as inverter switches, had initially been placed on test in an experimental installation. Also that subsequently, a "greatly improved" transistor converter drive, rated at 3 kva, and a controlled rectifier converter drive, rated at 7½ kva, were tested with gratifying results.

In summary, the authors said that after more than three years of development, the broad objectives "are close to realization." Basic circuit techniques have been determined, they declared, saying that additional work will be directed at reducing the size and cost, and increasing the power output and frequency range of existing converter designs. Also on achieving set point speed regulation on the order of ±0.01 per cent. Consideration is further being given to the development of drives operating at ultra-high speeds, they indicated.

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4. Perpendicularity of axis of pin bore to axis of skirt cylinder is checked. Tolerance: .001" inch per inch; failing parts rejected.

5. I.D. of pin hole is checked at 4 points. Over and under size rejected.

PIN LINES

6. Meanwhile, RCA Non-Mar Hopper feeds piston pins into Piston Pin Inspection Machine:

7. O.D. is checked at both ends. Over and under sizes are rejected.

8. OK'd pins are classified into 5 acceptable categories in increments of .0001".

9. Pins pass through 5 segregating gates and are fed to non-mar type storage bins or chutes.

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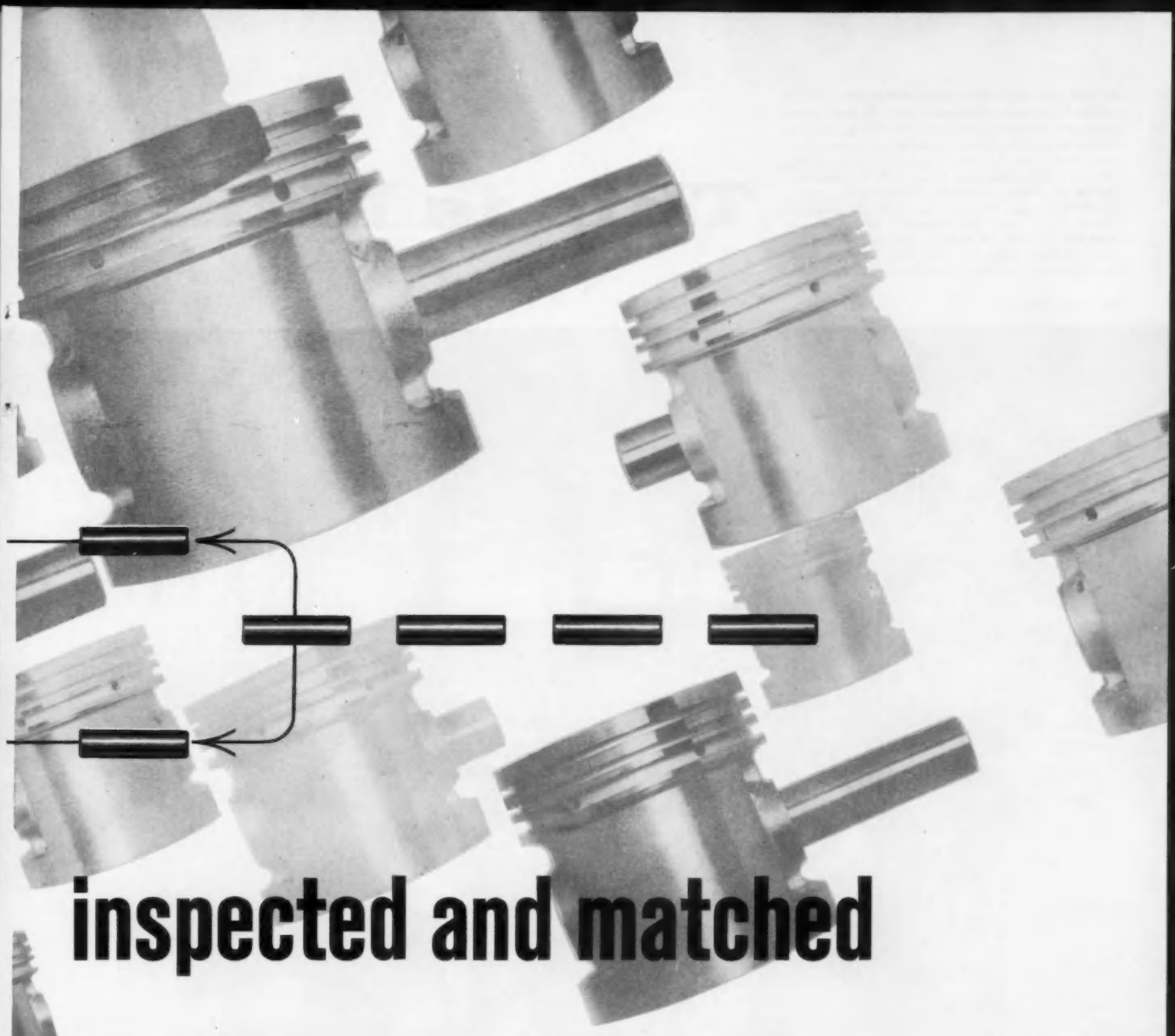

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This is McKay

Photo by Arnold Newman

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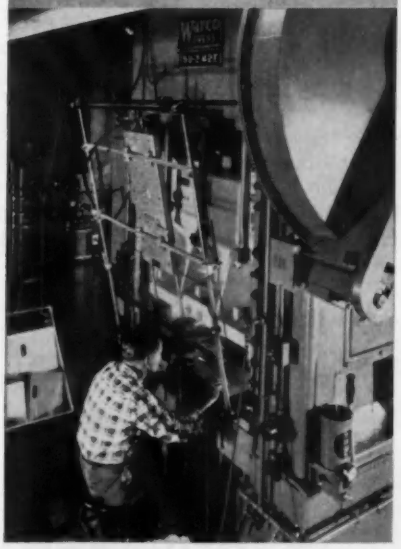
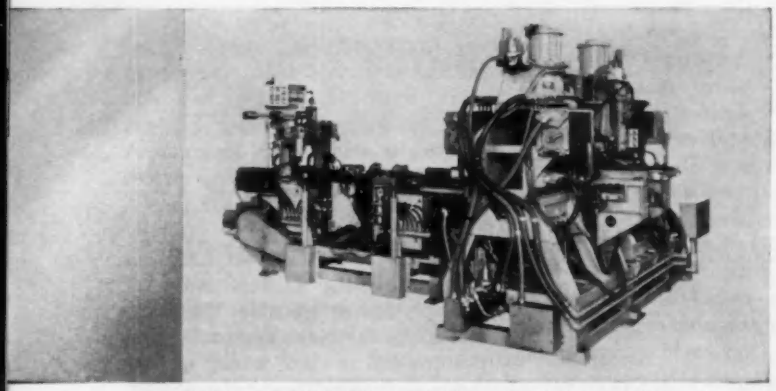
WARCO MECHANICAL PRESSES—advanced in design, noted for their craftsmanship—are used throughout industry. Typical is the high speed, low maintenance 150-ton straight side crank press pictured here in operation at Eastman Kodak.





FEDERAL RESISTANCE WELDERS AND WELDING LINES, like this multi-gun combination spot and projection welder used by Hotpoint on their range production line, can be found in the plants of leading metalworking firms the nation over. Individual units, or complete resistance welding lines, are engineered to specifications by McKay's Federal-Warco Division.

LOOK TO

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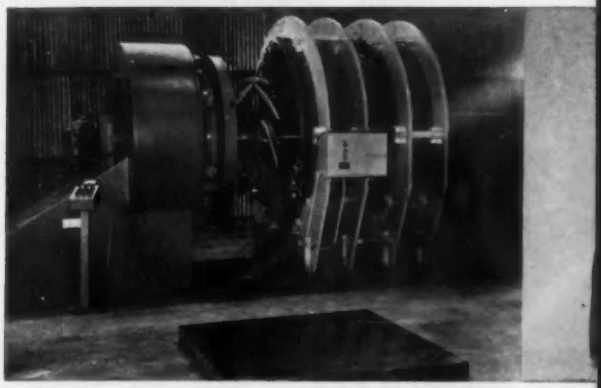

BERKELEY-DAVIS AUTOMATIC ARC WELDING MACHINERY produced by Berkeley-Davis, Inc., a subsidiary, is highly popular in the aircraft, rocket, automotive and appliance industries. The rocket body welder pictured here is working at Aerojet General, subsidiary of General Tire and Rubber Company.

METALS

Demand from Detroit Has Been Principal Factor in Upturn of Orders for Steel. Mill Delivery Times Are Stretching Out.

By William F. Boericke

The Recovery in Steel

Any doubt that the steel industry is making a definite recovery from its long slump has been dispelled by the cheering figures of increased output week by week. Since mid-March ingot production has risen regularly. By mid-May output had increased over 20 per cent in the two months period and had topped 1,900,000 tons a week. It is now estimated that the second quarter will show a gain of at least 20 percent over the first quarter. May production should be above 8,300,000 tons and June should be even higher. All present indications point to an output of over 100 million tons for the year or about 69 per cent of the annual ingot rate capacity in 1960. This is in sharp contrast to the 50 per cent operating rate early in January.

Steel demand from Detroit has been the principal factor in the upturn but increased orders are evidenced from practically all consumers. Steel users who have been on the sidelines for months have finally decided that their inventories are far too low. The days are gone when rush deliveries could be expected as a matter of course. Mill delivery times are stretching out. The strongest items are tin plate and galvanized sheets with the mills practically sold out through June. For galvanized sheets, delivery time is seven weeks ahead and tin plate consumption is more than last year.

Shipments Rise from Service Centers

Steel service centers across the country report that business is picking up faster than expected and many declare that shipments are the best since April, 1960, with especial activity in New England and the Pacific Northwest. The size of the average steel order is increasing. Consumers appear anxious to get their orders filled before the usual production decline occurs in the vacation period in July. In other years a substantial number of shutdowns were expected when the workers took time off. But it may well occur that with inventories low and a business improvement now thoroughly established that the summer seasonal slump in production will be much less than in the past.

Inventory Liquidation Ended

The chairman of U. S. Steel has asserted that the change from inventory liquidation by customers to one of buildup would start close to the end of the present quarter. Quoting some figures, he said that customer inventories a year ago had risen to over 16 million tons or higher but had been reduced to about 8 million tons at the end of March. He did not deny that competition from foreign steel remained very keen. Early in 1961 steel imports exceeded exports from this country. Nor could competition from other materials be overlooked.

No general price increase in steel appears imminent while 30 per cent or more of the industry's capacity remains idle. Another wage increase for workers is automatically effective in October. By that time if capacity is up to 75 per cent, as is now expected, there may be another story.

Scrap Demand Is Off

In contrast with the cheerful faces of steel producers and distributors the scrap dealers are an unhappy group. Historically rising scrap prices presage a higher operating rate for steel, but this hasn't proved true today. The price down-trend still continues. Dealers declare that the export demand for scrap is declining and mills are increasing the use of hot metal in open hearth charges instead of using scrap. Heavy inventories of iron ore in the yard and improved blast furnace techniques have not promoted scrap usage.

Copper Sales Continue Strong

The copper price appeared to be on the verge of moving upward from 30 cents to 31 cents in mid-May. In London the metal was well supported at 30 cents which would indicate about 32 cents delivered in New York after the tariff. On the Commodity Exchange copper futures were all selling above 31 cents with speculation rampant. Both producers and smelters were practically sold out of May copper and June metal was being priced to users at date of shipment, or at monthly average. Copper scrap was in firm demand at 26¼ cents, equivalent to 31¾ cents for electrolytic deliverable 90 days hence. As the New York price was the lowest in the world an adjustment upward was to be expected at no distant date.

Factors favoring a higher price include the firm recovery of U. S. economy, the still uncertain African situation, the increasing demand for copper from Europe and especially from Japan, and the possibility of a strike at Kennecott's western mines in July that would follow any failure in wage negotiations. Meanwhile copper producers still are curtailing production, except Kennecott which is operating at full capacity. ■

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Ask an M&T plating engineer to explain all the advantages, survey your needs for current and 1962 models, and give his recommendations.

*CASS test: copper-accelerated acetic acid salt spray. †Corrodkote test: a standard, uniform, highly corrosive slurry is applied on test piece, which is then placed in non-condensing humidity cabinet. Each cycle is 16 hours.

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By C. J. Kelly
ASSISTANT EDITOR

Chuck Jaws 1

Custom chuck jaws and special holding devices are described in a new booklet. Numerous illustrations show the various applications of these custom jaws and special holding devices in actual production applications. *Royal Machine & Tool Corp.*

Ball Piston Pumps 2

A six-page bulletin discusses design, operation, applications and efficiency of variable delivery ball-piston pumps for advanced hydraulic systems. Specifications, a performance curve, and a schematic hydraulic circuitry diagram of the pumps are also featured in the text. *General Electric Co.*

Hydraulic Cylinders 3

A complete line of hydraulic cylinders are covered in a new 20 page publication. Line drawings, charts, construction features and specifications are shown along with numerous illustrations. An internal cut-away shows all working parts of a cylinder. Models are covered in a range of 1⅛ to 8 in. bores with up to 2000 psi operating pressures. *Sheffer Corp.*

Container Data 4

A new illustrated booklet has been printed to help manufacturers select the proper shipping container. The first section of the 34-page brochure describes in individual detail a broad range of basic corrugated container designs. A second section discusses special container designs for products that are unique in shape, size or construction, or require special protection during transit. *Olin Containers.*

Solution Resins 5

Complete information on the preparation and application of vinyl solution resins for coating metal, wood, paper, fiberboard and rubber is contained in Service Bulletin G-15. Included in the 24-page booklet is a listing of the physical properties of Geon resins suitable for solution coatings. The booklet also contains detailed information on the formulation of these solutions. Included in this section is a discussion of mixing techniques, solvents, plasticizers, stabilizers, pigments, resins additives and viscosity characteristics. *B. F. Goodrich Chemical Co.*

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Welding Equipment 6

Catalog 170 is a new, completely revised and illustrated pocket edition. It covers a line of oxy-acetylene welding and cutting equipment and allied soldering-brazing equipment. The publication consists of 24 pages. *Modern Engineering Co.*

Inspection Gages 7

An idea book picturing many ingenious gage modifications, of interest to inspection engineers, is available. The 84-page booklet, entitled "Ideas", shows how standard Boice components can be incorporated in special and unusual gaging assemblies. Simple solutions to many common gaging problems are shown. Illustrations throughout the booklet show special parts of the assemblies shaded, while stock components are shown without shading, for easy differentiation. According to "Ideas", adapting standard components to fit into special gage assemblies saves both time and cost, and assures availability of replacement parts from stock. *Boice Gages, Inc.*

Specifications 8

The latest issue of the "Mil-Spec" Catalog carries references on over 450 specifications, and has been found indispensable by many users of Specification products in the field of lubrication, hydraulics, corrosion prevention, and similar specialized areas. In addition to the numerous references for current specifications, the list gives the Military Specification equivalent for approximately 300 Aeronautical (AN-), Air Force, Army, Navy, SAE and Aerospace manufacturers' specifications. Also available, by special request, is a list of 90 NATO Symbols and the equivalent U. S. Specifications. *The Don Harrington Co.*

Takeups 9

Seven frame styles of takeups equipped with sleeve, ball or roller bearings are described in an illustrated, 16 page booklet called "takeups" 2741. It contains a description of the company's line, including the latest models. Complete information for selection and application with dimensional data for each frame is given. *Link-Belt Co.*

Automation 10

A wide range of machines and equipment designed to automate metal finishing operations is described in a fully illustrated 29 page "Guide." Featuring photographs of actual installations—including the world's largest electroplating facility—the new booklet provides profit-increasing data for large or small firms contemplating automation. Entitled "WHEN TO AUTOMATE" the booklet also illustrates new types of automatic machinery currently in use by electronic firms for mass production processing of vital components. Extensive and detailed tables show: electro-chemical equivalents of base and noble metals; data on depositing zinc, copper, tin, nickel, cadmium and chromium; and separate tables for use with acid, cyanide and other recommended solutions. *The Meaker Co.*

Measuring Unit 11

Eight pages cover an instrument which is designed to measure and record roundness, flatness, roughness, waviness, scratches, flaws and total profiles of practically any type of surface that can be produced by normal production methods. The booklet shows the machine in action on a typical production operation and includes detailed data on the flexible unit. The last page shows records of inspection and lists what the inspected subject was. *Micrometrical Mfg. Co.*

Computer Technology 12

"New Solutions in the Science of Simulation," a 20-page, illustrated brochure details the latest advances in computer technology and equipment. Included is a report on the new 800 DYSTAC DYnamic STorage Analog Computer). The brochure also presents a run-down on company history and capabilities, as well as the company's line of precision products and components used as accessories to central computer consoles and for other applications. One section is devoted to a review of projects in which CSI equipment is being used to solve complex simulation problems of astronautics, astrophysics, ballistics, chemical and atomic research, process design and industrial manufacturing system. *Computer Systems, Inc.*

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Inspection Manual 13

A new and definitive inspection manual governing protective zinc coatings on products hot dip galvanized after fabrication should prove an invaluable aid to product inspectors, designers, as well as the galvanizing industry itself. Entitled: "Inspection Manual for Hot Dip Galvanized Products," the 34-page book has been prepared in cooperation with the American Hot Dip Galvanizers Association, Inc., to help manufacturers achieve optimum corrosion protection from the galvanized coatings on their products. In comprehensive and concise form, the manual describes significant factors governing inspection, properties, specification, and purchasing, of hot dip zinc coatings. *American Zinc Institute, Inc.*

Flexible Hose 14

High pressure aircraft and extra high pressure missile flexible hose assemblies of Fluoroflex-T (Teflon) for pneumatic and hydraulic systems are described in a new 8 page catalog. Design details for Fluoroflex-T hose assemblies, rated for service from −67°F to +450°F and ranging from 3000 psi heavy-duty impulse service to 6000 psi limited surge service, are included. Typical service applications in hydraulic and pneumatic systems include flight controls, braking, starting, ejection equipment, landing gear, gimbal control, launch equipment and many others. *Resistoflex Corp.*

Electrodes and Wires 15

A new 44-page brochure discusses hardfacing electrodes and wires. A cross-referenced, pictorial layout—in which all the hardfacing materials are classified and illustrated according to use—makes it convenient to find information in the booklet. The wear protection provided on industrial and construction equipment by Airco hardfacing alloys is discussed in detail. A description of each electrode is presented along with application data. Over 100 specific equipment parts that benefit from hardfacing are listed in an extensive section, together with the type of wear to which each is subject and the alloy needed to protect it. *Air Reduction Sales Co. Div. of Air Reduction Co., Inc.*

Industrial Engines 16

New Diesel turbocharged industrial engines are discussed in new data sheets. Included are technical specifications, charts and an installation diagram. Also available are sheets covering marine specifications of other models. The technical sheets are cover models MP-224T and MP-24T, industrial engines, and MP-BBDT and MP-BDT marine types. *Murphy Diesel Co.*

Torque Converters 17

Form C270 describes new 12 and 13 in. wheel C270 series industrial torque converters. The four page folder covers units intended for such applications as heavy-duty lift trucks, loaders, crawler tractors, wheel tractors and other vehicle and stationary power transmission which have input hp capacities up to 125. Specifications in the folder include a cutaway section of the torque converters, dimensioned interior and exterior drawings and a selection chart of input horsepower and rated rpm. *Clark Equipment Co.*

Seals & Packings 18

An eight page catalog describes and illustrates various types, sizes, operating features and advantages of a complete line of solid urethane hydraulic seals and packings. It covers the physical characteristics of Disogrin, an urethane elastomer, and shows why the material is well suited for solving sealing problems in hydraulic and pneumatic equipment. Three pages of tables show the range of sizes and types of seals and packings that are available. *Disogrin Industries, Div. of Pellon Corp.*

Tubing Buyers Guide 19

Four pages show principal characteristics, size range and relative cost of carbon and alloy steel tubing for mechanical, structural and hydraulic applications are set forth in easy-to-compare style. Stainless steel, aluminum and industrial plastic tubing are also covered. Tips on when to use tubing instead of bar stock for parts production, and how to buy tubing economically, round out the data. *Joseph T. Ryerson & Son, Inc.*

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Corrosion Preventive 20

A new, water clear coating is described in a four-page booklet. Developed to prevent oxidation, the new coating is reported to be resistant to mild acids and caustics. Called WC-1000, it can be applied over all finishes, old or new. Once applied it will cap in ten minutes and dry to a hard finish in four hours. The manufacturer reports it will eliminate the polishing of automobiles. *Leonetti Enterprises.*

Research Report 21

A new illustrated research report reveals that the primary cause of erratic performance and "inexplicable" premature failures of precisely engineered metal wear parts and bearing surfaces is the unsuspected and widespread presence of microscopic, nonmetallic, abrasive contaminants, mechanically embedded or electrostatically "bonded" to components. This 8-page technical paper summarizes the results of a two-year investigation undertaken by *The Research Div. of The Electrolizing Co., Div. of Advance Industries, Inc.*

Dies and Molds 22

The Where, Why and How concerning dies and molds are discussed in a new 16-page brochure. It has many illustrations and charts to clarify the given data. 12 subjects are covered in the literature. *Meehanite Metal Corp.*

Tool Bits 23

Six pages describe and illustrate a new series of tool bits. Design features, materials of composition, functions and advantages are covered. Information on how to grind tool bits for satisfactory performance is also included. *Morse Twist Drill and Machine Co.*

General Catalog 24

New, 240 page multi-color Catalog No. 161 illustrates and describes a complete line of electric ovens, furnaces, baths, environmental cabinets, related temperature control equipment and accessories. It includes many new models being introduced for the first time together with all the units added to this line since publication of the last general catalog in 1958. *Blue M Electric Co.*

Switchgear 25

Bulletin GEA-7190, 8 pages, gives detailed information on the features, maintenance and simplified installation of outdoor enclosures used with metal-clad switchgear. Publication details five steps in the eight-hour installation of metal-clad switchgear with protected aisle, and includes photographs, dimensional drawings, ratings and weight tables of outdoor metal-clad with protected aisle, with common aisle, and outdoor metal-clad switchgear breaker compartments. *General Electric Co.*

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A Tinnerman T-Marked Original...

Dual SPEED NUTS® open door to 20% savings on as-assembled cost

Gibson refrigerator door hinges are held in place with new cost-cutting, time-saving twin-type SPEED NUTS. They replace 3/16" plate hinge retainers which had to be drilled and tapped for machine screws.

Gibson Refrigerator analysts estimate that special twin-type SPEED NUTS save 14% on the cost of each hinge retainer assembly, 20.5% on the as-assembled cost. Labor is reduced by half. Former problems with cross-threading and stripping are eliminated . . . SPEED NUTS and A-type screws go together naturally every time—and faster!

The T-mark of quality and dependability identifies the more than 10,000 variations of SPEED NUT brand fasteners. From this unlimited selection come many saving opportunities for you. Ask your Tinnerman representative to arrange for a free FASTENING ANALYSIS of your product. An engineering service that may produce similar savings for you.

You'll find Tinnerman under Fasteners in your SWEET'S Product Design File and in the "Yellow Pages." *Tinnerman Products, Inc., Dept. 12, Box 6688, Cleveland 1, Ohio.*

TINNERMAN
Speed Nuts®
Look for the Tinnerman "T"

Circle 102 on Inquiry Card for more data

OTHER T-MARKED SPECIALS

SPECIAL "J" SPEED NUT cuts production time in half for a major gas range manufacturer. Simplified right-angle panel or brace attachments for a variety of appliance, cabinet, and instrument applications. Live-spring tension means a vibration-proof grip.

SNAP-IN FIXTURE FASTENER developed specially for Imperial Lighting Products Co., trimmed 80% off lighting fixture assembly time. Once fastened to the ceramic socket, this unique SPEED NUT snaps quickly into the fixture base...replaces three parts.

PUSH-ON SPEED NUT anchors latching bars on steel desks, reduces material and assembly costs by 50%. Push-on SPEED NUTS can be attached on studs, rivets, or tubing in a split second, and eliminates need for threaded parts . . . saves time and money.

CANADA: Dominion Fasteners Ltd., Hamilton, Ontario. GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S.A., 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Mecano Simmonds GMBH, Heidelberg.

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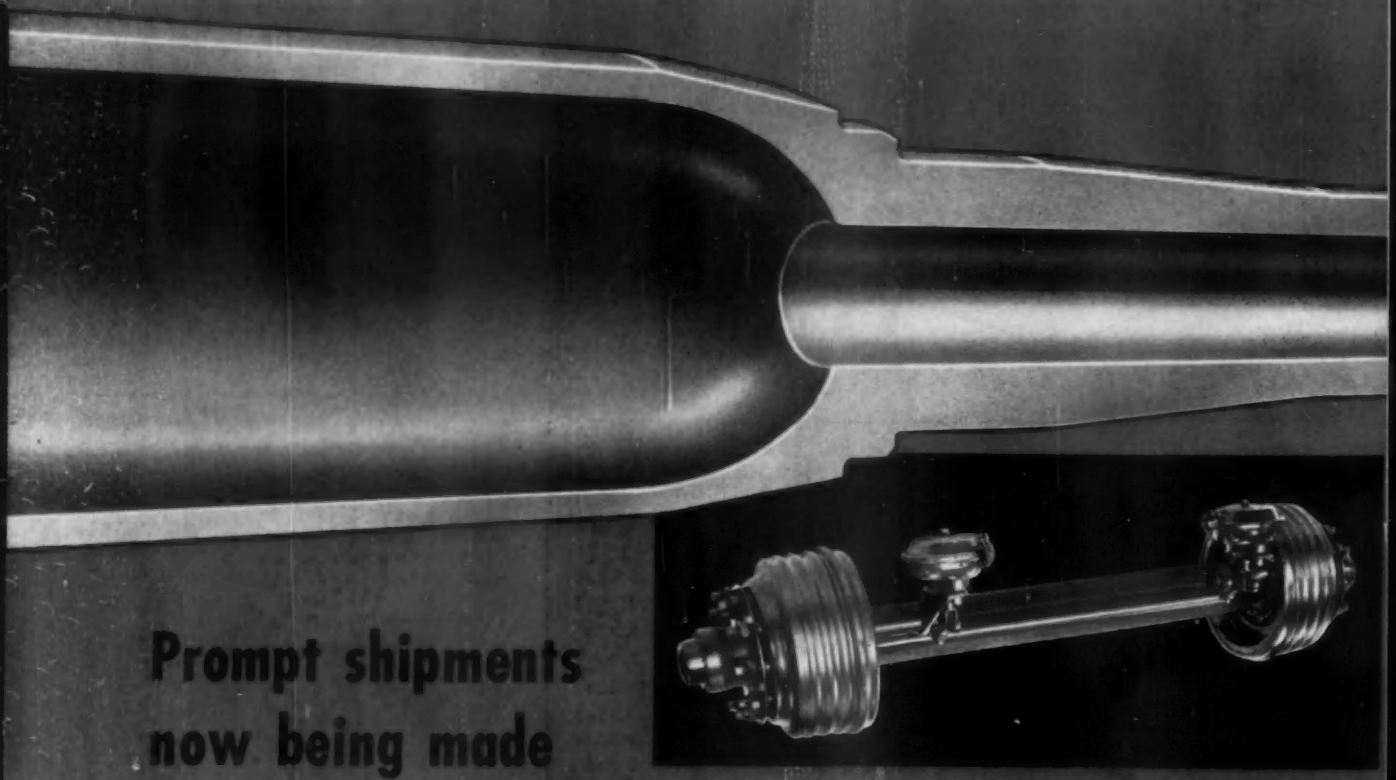
New lightest-weight SHULER AXLE creating great interest



Prompt shipments now being made

IN February, Shuler announced a completely new light-weight trailer axle—product of five years' research and the development of a tough and rugged new steel.

A major breakthrough in engineering design, the new Shuler axle weighs 50 pounds less than the 20,000-pound-capacity Shuler tubular axle it replaces. Strength is equal.

Inquiries and orders for sample 20-L axles have been pouring in at a record rate, and shipments are now being made. If you have not yet sent for full details, we urge you to investigate this major new achievement. Address:

SHULER AXLE COMPANY
Incorporated
2900 Second Street, LOUISVILLE 8, KENTUCKY

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